APRIL, 1959
Vol. 13, No. 4

food technology

THE JOURNAL OF THE INSTITUTE OF FOOD TECHNOLOGISTS

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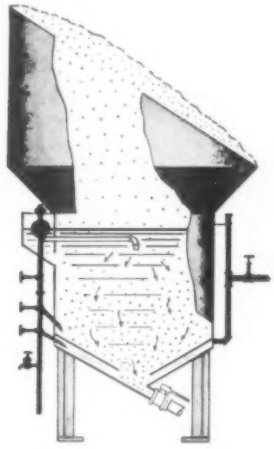

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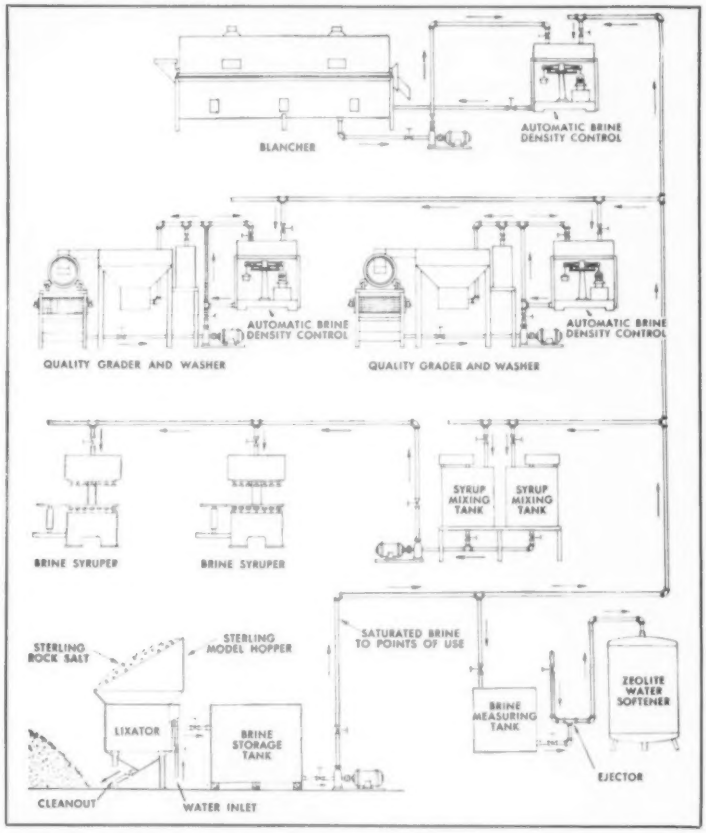

FLOW DIAGRAM illustrates the important, multiple uses of Lixate Brine in food processing. The high purity of Lixate Brine makes it ideal for washing and preserving fruits, vegetables and fish before they are packed and during their preparation. Its known density (*always* 100% saturated) makes Lixate Brine perfect for quality grading of peas, lima beans, grains and nuts by gravity "flotation." Lixate Brine is also used extensively in salt/sugar syrups, and for water-softener regeneration.

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FT food technology

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- Other foods having a water base

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IN THIS ISSUE—

THE TECHNICAL ARTICLES IN BRIEF

Flavor stability *Frozen fried chicken*

Time-temperature tolerance of frozen foods. XVII. Frozen fried chicken. Helen L. Hanson, Lorraine R. Fletcher, and Hans Lineweaver.

The flavor stability of commercially prepared frozen fried chicken has been determined for storage temperatures from −10° F. to 20° F. in the original retail packages and in hermetically sealed cans with either air or nitrogen atmosphere, for periods from 2 weeks to a year. The rate of flavor change was found to be approximately equal in fried chicken from two commercial sources and one laboratory preparation. Flavor changes were detected more readily and peroxide values increased more rapidly in the meat than in the skin and coating, indicating that flavor instability is as serious in the meat as in the outer coating, if not more so. Since rancid off-flavor was the most serious flavor change and is critical in shelf life, the effects of storage in an inert atmosphere were studied. Rancidity, which was detected after 2 months in samples stored at 20° F. in commercial containers, was not detected even after 12 months in nitrogen-packed samples at 20° F. It was detected at 6 months, however, in commercial samples (not nitrogen packed) held at 10° F. and in 9 months at 0° F. The relatively rapid rate of flavor changes in frozen fried chicken indicates the need for low temperatures (0° F. or −10° F.) and short storage times (6 months or less) unless it is packed in an inert atmosphere. (See page 221.)

Physical test *Haddock quality*

Rapid determination of the quality of whole, eviscerated haddock. J. T. R. Nickerson, T. L. Fazzina, L. J. Ronsivalli and B. E. Proctor.

A rapid physical test based on the refractive index of eye fluids has been developed as a criterion of the quality of fresh haddock. Correlation of this test was found with organoleptic scores on haddock fillets. The refractive index of the haddock eye fluid was found to increase rapidly during rigor mortis and increased as the quality of the haddock decreased. Optical density tests on eye fluids gave promising results but were not as suitable as refractive index measurements for indicating quality. (See page 224.)

Packaging *Differentially coated tin plate*

Application of differentially coated tin plate to food containers. R. D. McKirahan, J. C. Connell and S. J. Hotchner.

This study reviews the background and data leading to the introduction, in 1952, of differentially coated tin plate. The procedure by which this new material was introduced into food containers is described. Shelf life data for representative canned foods are presented to explain the basis for the transition from hot dip to differentially coated tin plate for the packaging of foods in metal containers. Present status of differentially coated plate and commercial considerations in its use are discussed. The future of this new material is indicated. (See page 228.)

April Cover. Symbol of Philadelphia, site of the 19th Annual Meeting of IFT, is the State House (Independence Hall). Through the efforts of Mr. Duncan Macpherson and by courtesy of the Free Library of Philadelphia, we are privileged to reproduce the original print (c. 1700) of an architectural rendering of the famous edifice by R. Bennett.

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Food engineering *Flash-entry evaporators*

Commercial scale evaporation of tomato products in flash-entry evaporators. A. I. Morgan, T. Wasserman, A. H. Brown, and G. S. Smith.

Product quality, sustained operation, and efficiency, in that order, are requirements for evaporators in tomato processing. Fouling of heating surfaces is a major problem to the processors of tomato puree and paste. Flash-entry evaporators of a new type are shown to have some advantages in each of the above categories. Rapid steam injection preheating and high liquid velocities minimize processing time and retard fouling. Data are presented covering commercial operation of flash-entry evaporators on tomato during 4 seasons. Results include quality factors, rates of evaporation, and rates of fouling on high- and low-solids tomato products. They show superior quality control, higher yields, faster evaporation rates, and good resistance to fouling on low solids feeds. (See page 232.)

Quality evaluation *Pork carcasses*

The effect of fatness on some processing and palatability characteristics of pork carcasses. R. L. Saffle and L. J. Bratzler.

The effects of different degrees of finish on various processing and palatability characteristics of pork carcasses were observed. Use of specific gravity as an objective measure of marbling and the use of single muscle fiber extensibility as a measure of tenderness were studied. From data obtained from the 75 carcasses used in this project it was concluded: There were differences in color of the *Longissimus dorsi* between the 3 finish groups. As degree of finish increased, hue shifted to a more yellow red range and lightness increased. Highly significant differences were found for cure loss of bacons. Ham cure loss decreased as fatness increased, but the differences were not significant. The difference in defrosting drip loss of the loin chops was highly significant, as finish increased, drip decreased. The mean values of the Boston butts and loin roasts indicated that percentages of defrosting drip loss were inversely related to the degree of finish, but not statistically significant. No significant differences were found for total cooking loss regardless of cut of meat used or method of cooking with the exception of bacon cooking loss, which was significant between the different finish groups. High correlation coefficients between specific gravity and both per cent fat and per cent moisture of the *Longissimus dorsi* indicated that specific gravity may be used as an objective measurement of marbling. The estimating equations for per cent fat and per cent moisture were $Y = 469.38 - 434.42X$ and $Y = -186.88 + 241.65X$, respectively, when X is specific gravity in both equations. Highly significant differences were found for taste panel scores of the loin chops between the finish groups, but no significant differences for either the hams or bacons. Low but highly significant correlations were found between taste panel scores of the loin chops and the following: specific gravity, ether extract, shear and muscle fiber extensibility. Low but highly significant correlations were also found between muscle fiber extensibility and both shear and marbling. (See page 236.)

Philadelphia and Surrounding Regions the Birthplace of Many Food Enterprises

Background Facts on the Region's Food Firms and Institutions [a]

FOOD TECHNOLOGISTS attending the Nineteenth Annual Meeting, May 17–21, in Philadelphia will find that Pennsylvania and its neighboring states participate in every phase of the industries of food and agriculture. Since most food technologists often are called upon for advisory services for their organizations, they may find this brief checklist and rundown of well-established food organizations in or near Philadelphia timely and useful. Instruments, machinery, additives, flavorings, packaging, consulting services, electronic "detectives"—all of these modern requisites of food manufacture and many more are available in the region. The background facts supplied for the various companies and institutions are not to be regarded as complete, but for further data, to use a well-worn cliché, all of these organizations will be as near to you as your Philadelphia hotel room telephone. They will welcome a visit.

WHO THEY ARE AND WHAT THEY DO

Their Enzyme Discoveries Have Catalyzed Food Industry Progress

Rohm & Haas Company, Washington Square, Philadelphia 5, became a pioneer producer of industrial enzymes by introducing to the leather industry the first synthetic bate, Oropon, and to the textile industry one of the first desizing agents, Rhozyme. In 1930 the company decided to expand its work with enzymes. Looking around for attractive opportunities, it selected the food industry as one in which enzymes play an important role in many processes. Accordingly, in 1931 the company introduced to the fruit-juice industry the first Pectinol enzyme concentrate for the clarification of grape juice. Pectinol acted upon the pectic substances in the juice to convert them into soluble materials. It precipitated suspended matter in the form of solids which could be easily filtered. Pectinol made possible for the first time the manufacture of clear, stable grape juice with all the original color and flavor. Extending its research, the company developed a complete line of Pectinol enzymes for use in the manufacture of sparklingly clear apple juice, wine, vinegar and berry juices.

In 1938 the company introduced Rhozyme preparations to manufacturers of corn syrup, thus opening the way to one of the most progressive steps in the history of candy-making. Heretofore, it had not been feasible for manufacturers of candy and chocolate to take advantage of the economy of corn syrup as a raw material because of the grainy, crystal structure the syrup gave to their products.

In the middle 1940's, the company expanded its line of food enzymes by introducing a new group of Rhozyme products into the baking industry. These enzymes were for the modification of so-called "bucky" flours, which had presented problems to bakers of bread on a large scale. Other Rhozyme products were developed for the preparation of protein concentrates from casein and fish waste. Others proved useful to manufacturers of pharmaceuticals in the formulation of digestive aids and dietary foods, and still others were developed for the ice cream, brewing and distilling industries.

In working with products for the food industry, Rohm & Haas chemists and chemical engineers have met successfully the challenging necessity of carrying out on an industrial scale sanitary manufacturing methods and rigid quality control that would do credit to the pharmaceutical industry.

They Originated the "Grade A" System

In 1876, during the Centennial Exposition, a Quaker farmer from Salem, New Jersey, began to deliver milk in Philadelphia. George Abbott, founder of Abbott's Dairies, was an 8th generation of Quaker farmers. In that early day milk was delivered to stores and homes by pushcart, and the area covered was necessarily an extremely limited one.

George Abbott was an inventor. In a period when refrigeration was practically an unknown quantity, he perfected a cooling device by which the cans of milk were surrounded by ice floating in water, and rotated by means of a paddle. Abbott was also a pioneer in the use of laboratory control to determine the bacterial content of milk. In those early years his brother, Henry Abbott, using the crude equipment of that day, was able to complete not more than ten bacteriological tests in a single day. In 1908 pasteurization of milk became compulsory by law. George Abbott purchased his first pasteurizer from the man who was to succeed him as President: Christian R. Lindback, then representing the Creamery Package Company.

Under Lindback's administration, Abbotts Dairies in 1914 introduced in Pennsylvania the first system of sanitary control of milk. Basis of this system was the routine bacterial examination of the milk as received from each farm, with a bonus to the producers for low bacterial count. This Grade "A" system was originated by Dr. Charles E. North, nationally known bacteriologist of New York City. From Henry Abbott's ten laboratory tests the bacterial examinations in Abbotts modern laboratories grew to several hundred a day. The "A" system was later widely copied throughout many sections of the country. The Grade "A" designation of this premium milk was later incorporated in the regulations of both Pennsylvania and New Jersey, and is so recognized today.

In the 82 years since the company was founded, Abbotts Dairies has developed into one of the largest independent dairies in the country. Its ice cream distribution reaches from New York City to Washington, covers all of New Jersey and Delaware, a section of Virginia, and a large portion of Eastern Pennsylvania. Consistently throughout its long period of growth, the company has used the laboratory as the yardstick for governing its standards of quality.

[a] Based on data supplied by organizations described.

While at the Annual Meeting of Food Technologists in Philadelphia you are invited to learn about American Food Laboratories, Patented, new Instant Liquid Stabilizer,* which eliminates the balling-up and lumping of many vegetable gums when added to food products.

- I.L.S. Instant Liquid Stabilizer disperses and hydrates instantly.
- Can be processed with hot or cold mixes.
- Available in pre-weighed unit cans.
- Won't break down at high temperatures.
- Needs no pre-mixing with sugar or water.
- Available in custom blends to suit your specific formulations.

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Pure extracts, concentrates or powders for superior flavoring.

Coffee
Pure liquid concentrates that retain complete flavor value.

Flavors and Extracts
Finest quality and highest concentration.

Superb Maple Flavors
Pure Maple Concentrates — both alcoholic and non-alcoholic for pure maple flavored syrups, ice cream, confections and icings. *Imitation Maple Flavors*—expertly compounded.

Annual Meeting of Food Technologists
Bellevue Stratford Hotel
Philadelphia, Pa., May 17-21, 1959

* Registered trade mark for American Food Laboratories' *Instant Liquid Stabilizer*. Product and AMFOLAB process Patented.

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They Make Vanilla, Soluble Vanilla Crystals, Rum Flavorings, and Other Delectables

David Michael & Co., Inc., founded in Philadelphia in 1895, specialized during its first half century in the making of powdered vanilla flavorings. Present equipment includes a continuous dryer with a capacity of 500 pounds per hour and a one-ton shelf dryer for making custom formulae. The company's latest development is an instantly soluble vanilla crystal, available either as a pure vanilla or in combination with other aromatics. **Michael** has operated a plantation in Puerto Rico for twenty years, engaging in research designed to develop modern methods for the growing and curing of vanilla beans and other tropical crops.

During recent years, the Michael line has been expanded to include vanilla extracts and syrups, fruit purees and cherries, citrus drink and sherbet bases, egg nog bases and flavorings, powdered and instant coffees, rum flavorings, maple flavorings and coconut products.

Both Walter M. Rosskam, president, and Eli Rosenbaum, vice-president, obtained their degrees in chemistry at the University of Pennsylvania. Eric Feyertag, with a doctorate from the University of Vienna, serves as Laboratory Director.

They Are Grocers to Millions

The American Stores Company is the nation's fourth largest food chain, and the seventh largest retail organization. In 1937, the company opened its first Supermarket at 69th and Market Streets, Philadelphia, called the "Marketeria." Gradually it expanded, going first into the Wilkes-Barre area and Johnson City, N.Y. The American Stores Company now operates in seven states—New York, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, and in the District of Columbia. With the expansion of territory came the expansion of company operations. Its cannery at Hurlock, Md., is responsible for a variety of canned products, and corn and peas are packed at the cannery at Fairwater, Wis. American Stores Company meat packing plants are located at Lincoln, Nebr., and Pueblo, Colo. Cattle are bought on the hoof in these areas and fattened in the feed lots to control the quality of the

meat from its home on the range to the range in the customer's kitchen. Butter for the company is churned in Minnesota and Wisconsin, and buying offices are maintained in St. Paul and San Francisco. The American Stores Company's only foreign operation is a processing plant in Colombia, South America, which takes raw coffee from the grower and processes it for shipment to the blending and roasting plant in the United States. The American Stores Company employs more than 25,000 persons and buys merchandise from countless producers and manufacturers.

This Institute Revolted Against Tradition

Drexel Institute of Technology, founded in 1891 by Anthony J. Drexel, Philadelphia financier and philanthropist, furnishes the food industry, as it does many other industries, with well-trained technical personnel. It has an established place in the educational world but it was not always thus. As early as the decade following the Civil War efforts were made to break through the classical pattern of thought that dominated our liberal arts colleges. Science and invention appealed to the inquiring minds of Americans, few of whom had sufficient early education to qualify them for industrial careers. It was natural that the first expression of the educational revolt should be the establishment of industrial schools for the lower echelons of technical employment.

Drexel, however, was established on definitely higher standards of scholarship and performance. With other institutes of applied science established in the same era, Drexel specialized in engineering, business administration and home economics. It may be said that the enormous growth of American technology over the last six decades has been made possible by the ingenuity and competence of the graduates of technical institutions.

Like other institutes founded at the turn of the century, Drexel rapidly effected changes in criteria for admission, standards of accomplishment and curricular content which led to collegiate status for its work. The first bachelor's degrees were granted in engineering in 1915, in home economics in 1919, and in business administration in 1926. Drexel is a member of the Association of American Colleges, the Association of Urban Universities, the American Council on Education, and the Middle States Association of American Universities as one whose graduates are recommended for graduate study, both here and abroad.

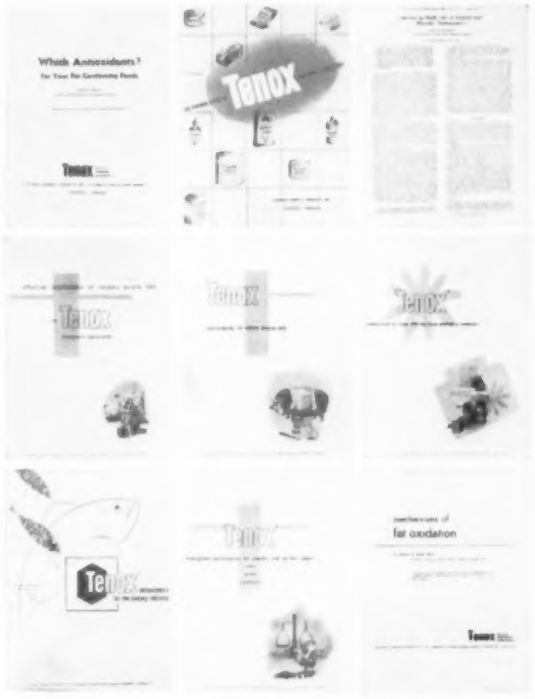
The founders of Drexel built for the needs of their own time, as they saw those needs in industrial Philadelphia, but they also anticipated the needs of the future. Each of the four constituent day college divisions, as well as the Evening College, is today a modernized expression of the original concept of the Institute. Perhaps the most notable indication of this is the plan of cooperative education, in operation since 1919, under which business and industrial organizations cooperate with the Institute by enabling students to acquire practical experience related to college studies through alternating periods of service in their organizations. Each year some five hundred firms located in fourteen states and the District of Columbia employ Drexel students on cooperative assignments.

▶ This literature can help you

broaden your product line
expand your marketing area

Longer shelf-life, gained through the intelligent use of antioxidants, has often spelled the difference between success and failure in marketing a food product. Key to the intelligent use of antioxidants is, first, an understanding of their function.

To help you obtain that understanding, Eastman offers the following literature.



- WHICH ANTIOXIDANTS FOR YOUR FAT CONTAINING FOODS
- THE EASTMAN FAMILY OF TENOX FOOD-GRADE ANTIOXIDANTS
- INCREASING SHELF LIFE OF CEREALS WITH PHENOLIC ANTIOXIDANTS
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They Find the Plus In Surplus

The Eastern Utilization Research and Development Division of the USDA's Agricultural Research Service is one of four famous research centers in this field. The others are the Northern in Peoria, Illinois, the Southern in New Orleans, Louisiana, and the Western in Albany, California. Their research is designed to find new uses, or to expand the existing uses, for agricultural commodities, especially those in surplus.

Much of the work is done to establish a larger place for farm crops as industrial raw materials, but for those which are essentially foods—such as fruits and vegetables, meat, and dairy products—basic and applied research is directed toward improving the quality and convenience of processed food products. Success in this field gives farmers profitable processing outlets for the foods they produce in excess of fresh-market needs.

The Eastern Division's process for recovering the volatile flavoring constituents of apple, grape, cherry, and other fruit juices during their processing has opened up many new possibilities in the field of concentrated fruit juices and powders. Restoration of this "essence" to the product after concentration makes possible full-flavor frozen concentrates (4-fold), super-concentrates (7-fold), and juice powders that keep for more than a year without refrigeration.

Research at the Eastern Division has produced potato flakes, a new form of dehydrated mashed potatoes. This new product, now in its second year of commercial manufacture, can be made from a wide variety of potatoes, and is gaining large markets around the country in both the institutional and retail trades.

Research on meat and cheese is done at the Beltsville, Maryland, laboratories of the Eastern Division. The meat research is concerned with such processing problems as the perishability of cured meats, the "binding" properties of meat which are important to the quality of sausage and other comminuted products, and the tenderization of beef. New labor-saving methods of making Cheddar cheese are among the developments of the Beltsville laboratory designed to improve this dairy product in economy of production and in quality.

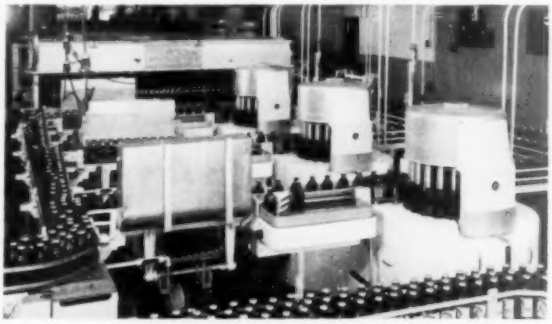
Some of the most noted basic research of the Eastern Division has been concerned with the proteins of milk, especially casein. Eight of the annual Borden Awards in the Chemistry of Milk have been received by scientists working in this and related fields at the Philadelphia laboratory and at USDA laboratories in Washington, D.C., which are now part of the Eastern Division.

An important problem included in the Eastern Division's dairy research concerns the development of a satisfactory dry whole milk. Laboratory-dried milk has been produced that disperses instantly in cold water and makes a drink with full fresh-milk flavor. A dry whole milk that can be produced by a commercially feasible method and will store without flavor loss for several months is the goal of present research on this product.

Their "Radio Eye" Rings Bells, Flashes Lights!

Electronic detectors are at work today in hundreds of plants turning out packaged food, candy, chewing gum, beer, and soft drinks, making certain the end product is pure and safe. Foreign objects, ranging from bits of packaging materials to hairpins, long have posed a problem in the food, confection, and beverage industries. Producers of electronic equipment, led by the **Radio Corporation of America,** have come up with the answer.

A typical application of electronics to the situation is the use of RCA's metal detector with a "radio eye" that has the ability to peer inside cereal boxes or a candy bar and pinpoint bits of metal or other unwanted "intruders." Candy makers have been plagued by the fact that their cooking kettles, tanks, and pipes become coated with deposits on the interior surfaces. These deposits flake off from time to time and may wind up in the finished product. The flaking fragments often take with them bits of metal scale from the tank or kettle.



RCA electronic beer inspection machines (turret-like units) unblinkingly scan bottled beverages; automatically and instantly detect and reject those containing inadvertently bottled foreign particles.

These tiny metallic pieces can be spotted electronically by the modern day watchdogs. The radio eye's reaction to the presence of such foreign material is to set in motion an alarm system with ringing bells and flashing lights. Not only does the metal detector assure a better product in the food-stuffs industry, but the electronic device helps protect intricate and costly machinery from damage by the same sort of "wandering" metallic pieces. The device utilizes specially designed coils to produce a high-frequency electromagnetic field. The passage of any metallic substance through this field causes a distortion of the field, which in turn creates an electrical signal. This signal is fed to a control unit, is amplified and then used to trigger an alarm system.

RCA was a pioneer in the field of electronic beverage inspection. More than a thousand RCA Beverage Inspection Machines (IBM) are now in use in bottling plants not only in the United States but in a half dozen other countries.

They Keep Things All Corked Up

Crown Cork & Seal, as a Company, was founded in 1892 in Baltimore, Maryland. The founding of the Company was a result of the invention by Wm. Painter of a crown bottle top. In the late 20's the Company introduced caps for the milk industry and in the early 30's a line of continuous thread caps and lug caps for food, drugs, and cosmetics. In 1936, the operations were further expanded by the purchase of the old Acme Can Company in Philadelphia. A

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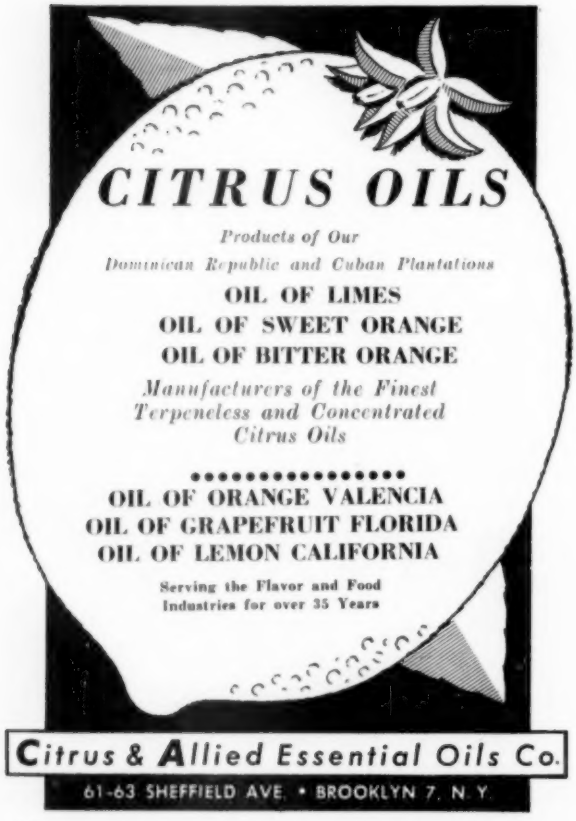
multi-million dollar building program went into effect at once in order to expand the Company's can manufacturing facilities at Erie & "H" Sts., and today this plant represents the 3rd largest single can operation in the industry.

Many important contributions have been made to the food industry from the combined manufacturing facilities of Crown. From the Closure Division first and most important the crown closure, which is still the standard of the soft drink and beer industries. Several improvements to this cap, such as composition cork liners, spots of various material, and shallow shell silhouette, plastic liners have been contributed through the years. Another was the now famous deep hook thread, a major inovation on continuous thread caps that resulted in a more uniform and better sealing type of cap for the industry. A line of milk caps produced from aluminum with a paper liner in the then revolutionary 38 mm. size were next introduced. The correctness of this move has been borne out by the acceptance by the industry of this size and type cap.

The can operations of the Company have made contributions to the packaging industry, for example, the introduction of the seamless beer can. Following the war, this type of can with its ability to withstand tremendous internal pressure was introduced as the first disposable aerosol container. The Company has kept abreast of the phenomenal growth of the aerosol industry with an expanded line of containers of all sizes, in both fabricated and spray-tainer types.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Grandfather Seabrook Had a Farm

Seabrook Farms in New Jersey is today the world's largest vegetable farming and freezing operation. The Farms' quality control operation begins with the selection of tested seeds and continues uninterrupted through the planting and growing process, to harvesting, freezing, and packing. Basically, Seabrook is a large-scale, scientific farming organization that has a way of marketing its crops 12 months a year. In a different organizational plan, four or five changes of hands, management and ownership of the output might be involved. It is a complex operation, involving a carefully scheduled ripening day, maybe even hour, to harvest the crops at the very peak of their perfection. A large part of the acreage is under controlled irrigation in an effort to control drought which can prove disastrous.

The beginnings of the world's largest fruit and vegetable farm go back to the 1880's. Grandfather A. P. Seabrook farmed 57 acres, 8 miles north of Bridgeton, N.J. He produced fine vegetables, which he sold house-to-house. The strains of his vegetables improved and his market expanded. People heard about his superb peas and beans, his spinach, and his baby lima beans. Before he knew it, Grandfather Seabrook was in the seed business. By the turn of the century, he was icing carloads of vegetables for shipment to Philadelphia, Baltimore, and New York. Today it is a 45-mile trip from one end of the domain to the other.

In 1908, reports came to the Seabrooks of a curious way of growing cauliflower in Copenhagen, Denmark. Water was piped overhead and rain sprinkled down whenever you wanted it. After extended investigation, an experimental and limited installation was soon put in operation. By 1912, the Farms used the new controlled irrigation with such success that it earned the incredible profit of $25,000. In 1923, when the farm had expanded to 5,800 acres, C. F. Seabrook mechanized the whole operation. Canning, begun in 1919, continued to grow in importance until 1930, when the Seabrooks joined with the late Clarence Birdseye in the original freezing of vegetables.

Through the years, there has been an unending crusade for improving strains of vegetables and fruits. Laboratory scientists study the special characteristics required for freezing and find answers. For example, the home gardening varieties of peas had fine freezing characteristics and excellent color, but they matured unevenly. Not more than one fourth of a crop was ripe at any one time, making machine harvesting unprofitable. On the other hand, the canning varieties matured simultaneously, from the top of the vine to the bottom. But for freezing, the color was a disagreeable slate grey. Seabrook scientists combined the two in a superb new strain that is absolutely perfect for mechanical harvesting as well as freezing.

The dramatic growth of Seabrook Farms as a major factor in the frozen food industry, was further evidenced in 1957 with the introduction of their frozen prepared foods in Miracle-Pack—a strong, but window-clear lamination of two plastic films, Mylar and Polyethylene (products of the du Pont Company). After the food is placed in the Miracle-Pack, the open end is welded together with heat.

Miracle-Pack prepared foods are heated by dropping the solidly frozen package into boiling water for 14 minutes and ready to serve by simply snipping

NEW RCA METAL DETECTOR

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See it in action at the
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This brand new RCA Electronic Metal Detector helps safeguard quality and protects your reputation.

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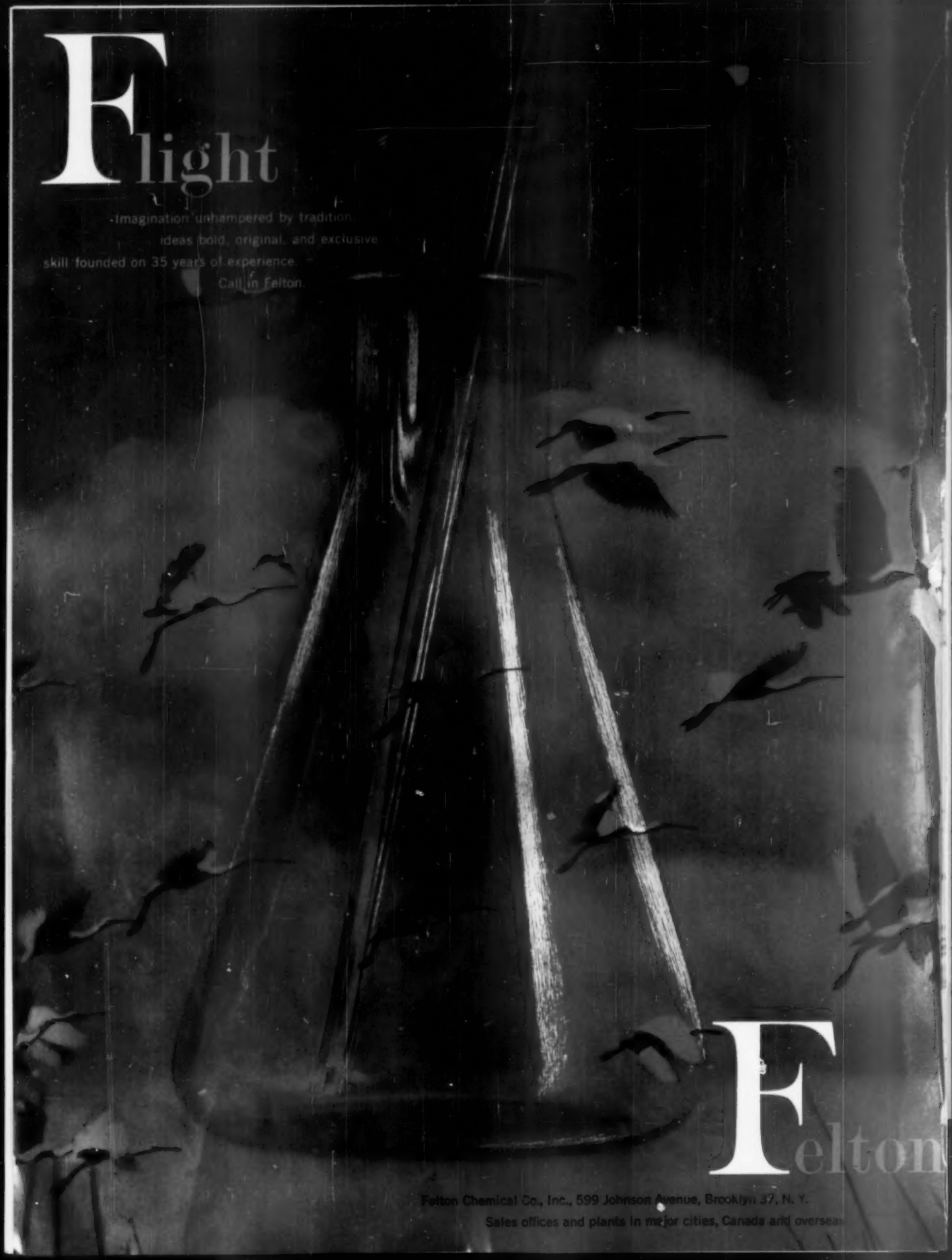
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across the top of the pack and emptying the contents. Any number of Miracle-Packs can be heated in one pan of boiling water.

The brief time needed to heat solidly-frozen foods with this method is a dramatic contrast to the long cooking times involved in oven heating of frozen food. The men behind the scenes at Seabrook Farms consider this the most revolutionary change in cooking since the development of frozen foods.

They Make Oil and Water Mix

A leading manufacturer of polyols, surfactants, and activated carbon for the food processing industries, **Atlas Powder Company,** a famous Delaware Valley supplier to food processors, is located about 3 miles north of Wilmington, Delaware. Although headquartered in the same city, Atlas is not a part of E. I. du Pont & Co. They are, in fact, competitors in some markets and customers of each other in other markets.

Atlas is best known in the food industries for its sorbitol and emulsifiers. Commercially produced from sugar, sorbitol, because of its unusual ability to maintain moisture balance and other characteristics, is in demand for candies and other confections, beverages, baked foods, and certain dietary foods. A wide range of Atlas emulsifiers are used wherever food processors need to mix oil or fats with water. Atlas emulsifiers have important applications in bread, cake mixes, shortenings, margarines, and ice cream. They impart finer texture, more uniform products.

Atlas' Darco activated carbons are used by food processors to remove unwanted color and impurties. Millions of pounds are used to purify sugars and syrups and edible fats and oils. Darco carbons are also used to prolong the shelf-life stability of beer.

Continued emphasis on research has led to the building of a new Technical Center to house the company's basic research and chemical product development activities in Wilmington. Atlas also has joined with 9 other companies to form Industrial Reactor Laboratories, Inc.—the world's first privately financed nuclear facility for industrial research—near Princeton, New Jersey.

Their Blenders Prevent Blunders

Blending techniques and processes in the food industry have changed considerably in the last 5 to 10 years—especially in the field of liquid-solids blending. New and radically different equipment has introduced wholly new concepts and modified old processes in blending. There is, however, no positive scientific way of predicting the results of difficult-to-blend materials. Any generalized testing of various types of blenders—with the objective of classifying them as best, good, or poor—is unsafe as a guide. The immediate practical approach is to make use of accumulated test data and experience to help select the type of blending equipment which has the best possibility of success. The most reliable guide at present is specific testing under rigid conditions which control, to the highest possible degree of accuracy, all those variables affecting the desired results in the blended food formulation.

Pre-testing has become an important factor in the design and manufacture of blending equipment. One of the pioneers in the development and manufacture of process equipment for the food industry—the **Patterson-Kelley Company**—has tested hundreds of various food and drug formulations at its Pre-Test Laboratory in East Stroudsburg, Pa. Here, laboratory engineers and chemists develop proper blending proportions, procedures, and timing for many different food products.

In pre-testing blending formulations, the company, a pioneer in the field of heat exchangers and other process equipment, uses one of several different types of blenders. These include the Twin-Shell dry solids blender, which consists of two cylinders cut at right angles and joined to form a V-shaped design. Based on a centuries-old mixing method, the fundamental Twin-Shell mixing principle involves a combined tumbling or rolling action with a simultaneous transverse movement within the entire mass of material. Also, a folding action is created by the combining and dividing of the mass during rotation.

P-K engineers also developed the Liquid-Solids blender, essentially an all-purpose blender for plain tumbling, dry mixing, and liquid-feeding into solids. The Liquid-Solids blender is equipped with a hollow cylindrical bar which revolves inside the shell. Revolving distributing discs on the feed bar, by centrifugal force, provide controlled liquid dispersion, whether a coarse spray for granulations or an extremely fine "fog" or mist for lump-free formulations.

Liquid-Solids blender applications in the food industry include adding vanilla to sugar, aromatic oils to instant coffee blends, shortening to cake mixes, spice oils to various spice mixtures, corn syrup to powdered sugar, and propylene glycol to food drink solids. The P-K Liquid-Solids blender has made possible many food ingredient mixtures heretofore untried or not adopted because of difficulties encountered in blending. Probably the most significant advance has been made in preparing granulations which, when liquefied, dissolve easily and rapidly.

Other P-K blending equipment used in the food industry includes the Vacuum Tumble Dryer—a completely self-contained unit for blending and drying heat sensitive materials—and a series of specially-designed packaged pilot plants for production testing before going "on stream." The company also manufactures double-cone and ribbon type blenders.

The House that Two Professors Built

LaWall and Harrisson, 1921 Walnut St., Philaphia, is the oldest continuously operating laboratory in the United States and probably in the world, that is devoted to the biologic aspects of the several industries it serves. The laboratories, which have served the pharmaceutical and food industries, and public, in general, for almost a century, occupy an entire building in the centrally located Rittenhouse Square section of Philadelphia. Originally founded in 1870 by a Quaker physician, Henry Leffmann, they were continued by an associate, Charles H. LaWall, an international authority on foods and drugs and later Dean of the Philadelphia College of Pharmacy & Science. The traditions of ability, experience, and integrity established by these internationally known scientists have been continued in LaWall & Harrisson under the directorship of Dr. Jos. W. E. Harrisson—student, employee, and later partner of Dr. LaWall.

Dr. Harrisson was for many years Professor of and Director of the Department of Pharmacology of the Philadelphia College of Pharmacy and Science.

The chemical work of the laboratories includes routine control examination for the pharmaceutical and food industries, including plant inspections for sanitation. Pharmacologic and bacteriologic studies include the standardization of such drugs as digitalis, estrogens, sterility tests, pyrogen tests, antiseptic and germicidal studies. Toxicity studies embrace acute, sub-acute, and life span (chronic) tests, as well as eye irritation, skin irritation, and skin absorption tests.

Experience carries the members of the staff into numerous other fields, such as advice upon the technicalities of Labeling Foods and Drugs, Development of Information for New Drug Applications, and Patent and Civil Law Actions.

Plans are now complete for expansion of the laboratories due to an increased need for biologic facilities to serve the food industry in testing food additives. Additional biological laboratories capable of housing several thousand laboratory animals, such as rats, dogs, rabbits, etc., will soon be in operation.

They Know How to Box

Since 1842, when Stephen F. Whitman started a small confectionery shop in Philadelphia, the **Stephen F. Whitman Co.** has experienced a continual growth pattern, until today, it is recognized as the largest manufacturer of boxed candies in the world.

In 1854 Stephen F. Whitman introduced the first packaged confectionery in printed boxes. This was the beginning of what is now called a "trade-marked" package and from which developed the packaged goods business of today along with all the related businesses necessary in making a modern box of candy. In January, 1912, the company introduced their now famous Cross Stitched Sampler box which today is considered to be the best known and best liked box of confectionery in the world. That same year Whitman discontinued the sale of bulk chocolates and by 1916, all of Whitman's candies were sold solely in packages.

Today the company sells more boxed candy than anyone else, and is constantly making improvements not only in their package designs (for instance, the beautiful valentine hearts) but also in pieces contained in each package. Also in 1912 Whitman scored another first when it became the first company in the candy industry to use cellophane wrapping in the packaging of its product. This was long before cellophane had been introduced in the United States. Although no records are available, Whitman might well have been the first user of cellophane for packing purposes in this country. This innovation immediately resulted in a tremendous increase of company sales.

Over the years there developed a need for rigid quality control in the manufacture of candy. Whitman pioneered many successful controls and systems which helped make candy manufacturing the science it is today. In 1930 Whitman developed what is believed to be the first automatic tempering installation in the country. In 1939 the company installed its first Moyno pump, a unique pump which moves chocolate coating with a reasonably high viscosity at 120°F. These pumps were so successful that Whitman was able to eliminate other types used previously which required considerable and frequent maintenance. Through its laboratories and its system of rigid quality controls, Whitman maintains in its candies a consistent quality and appearance, at the same time reducing manufacturing costs by various methods of automation. Today, Whitman, in its efforts to give the public an even better product, is experimenting with various types of wrappers to prolong the freshness of its candy. Constant safe-guarding of quality and product is a Whitman's must.

They Answer Particular Packaging Problems with Parchment

The **Paterson Parchment Paper Company,** Bristol, Pennsylvania, first introduced a genuine vegetable parchment in America in 1885. Since that time it has maintained its position as the largest producer of genuine vegetable parchment in the United States. Its product name "Patapar" is widely recognized and accepted throughout the packaging field.

Patapar is a genuine vegetable parchment, a unique paper manufactured by a two-step process from carefully selected pulps. It is fiber free, has high permanent wet strength and grease resisting qualities. It is non-toxic, odorless, tasteless, and since no chemical additives are used to obtain these properties, it maintains a high degree of purity, making it a very desirable food wrapper.

Modern packaging techniques have made new demands on parchment. Today, Patapars are coated for heat sealing, moisture protection, or decorative appeal. They are specially treated for releasing properties, or to act as a grease and oil barrier under severe conditions. Parchkin Motif Art Parchment, recently introduced, gives a totally new and different appearing packaging medium with decorative sales appeal. Patapar has long been a standby in the food packaging industry and will continue to serve as an economical, functional, and decorative packaging material.

They Lend a Hand In All the Various Steps of Providing Food

World population is increasing rapidly. In the United States alone the Bureau of Census projects that the population will increase from the present 171 million to 228 million by 1975. Whatever turn the economy may take this tremendously increased population will demand increased quantities of food. Many chemical materials are necessary aids in the growth, preparation, preservation, packaging, and distribution of food.

Although primarily a producer of chemicals for industry, **Hercules Powder Co.** is associated with food production and agriculture both as a user of farm products and as a supplier of materials needed by farmers and by food processors. In fact Hercules lends a hand in all the various steps of providing food, from clearing land to packaging food for retail distribution.

Hercules makes a number of materials that go into food products, mostly as processing aids. From the protein content of wheat flour comes MSG monosodium glutamate, a flavor enhancer; HVP hydrolyzed vegetable protein, a vegetable product with a meaty flavor; vital wheat gluten, used to improve the quality of bread and cereals; and other protein products.

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LOW D.E. DRI-SWEET cuts processing costs because products have less depression from the freezing point. This means less refrigeration is required at the freezer, hardening rooms and at the dealer's cabinets. You'll appreciate the convenience and ease of handling of a dry corn syrup solid too. OK LOW D.E. DRI-SWEET Corn Syrup Solids cost no more than regular sweeteners.

If you have any problems concerning ingredients for ice milk products, we'd like to help. Ask "The Man From Hubinger" about your special problems, or write or phone for information.

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Edible starch is also produced as well as laundry and industrial grades. Cellulose gum is a stabilizer used in ice cream, meringues, dehydrated soups, and other prepared foods. Dalpac antioxidant helps to avoid rancidity of certain fats used in foods.

The final step of getting food to the consumer requires packages. Hercules makes size for improving the resistance of paper to moisture; resins used in adhesives, and other resins used in inks for package printing; nitrocellulose to moistureproof cellophane; and Hi-fax high-density polyethylene for molded containers. In fact almost any package that comes into your kitchen may have utilized a Hercules product somewhere in its fabrication.

They Borrowed Tool and Die Principles for Making Macaroni

Philadelphia's importance as a market area for macaroni and Italian food specialties led **V. La Rosa & Sons** to build its newest and most modern plant in Hatboro, a northern suburb. This plant serves wholesalers and retailers in the entire surrounding area with macaroni products. It produces all of La Rosa's canned and frozen Italian specialties.

Here, under exacting laboratory standards, veteran chefs do the cooking of such specialties as Veal Cutlet Parmigiana, Baked Ribbed Lasagne, Chicken Cacciatore and Veal Scaloppine, and here too is where the finished dishes are processed and frozen for the entire Lo Rosa sales areas. The cooking and canning of the various sauces—marinara, meat, mushroom—and soups are also done under the same close control. In the manufacture of macaroni products at Hatboro, La Rosa uses machinery as modern as experience and technology can make it. For this purpose, La Rosa makes all its own dies, and maintains complete tool and die shops in the plant.

"In some ways," says Pete La Rosa, president, "macaroni making is a tool and die business." By this he means that most of the shapes are extruded through dies. Semolina in the uncooked state being a hard, milled wheat is tough on dies—its hardness gradually wearing down the die metal. And, as the die wears, the formed shape begins to change. So, the dies must be changed often to maintain the desired shape.

Every load of incoming products, including meats, is analysed at V. La Rosa & Sons to determine if the exacting specifications are met. Full-time chemists are employed for this purpose, and they work in an up-to-date, fully equipped laboratory. Only No. 1 semolina—the "heart" of durum wheat—is used for the macaroni products.

La Rosa also uses its Hatboro plant as a testing ground for new products, and new processing ideas as the company keeps pace with the growing complexity of today's food manufacturing and processing.

They Are Forever Blowing Bubbles

The Frank H. Fleer Corporation of Philadelphia makes Dubble Bubble Gum, the largest selling single penny confection in the world. Each year enough gum is sold to reach comfortably around the equator if you line the pieces end to end. To profitably make a product which still sells for 1¢ in these days takes technical know-how. The latest devices for controling

uniformity in the product, eliminating hand operations, speeding up production and improving quality are very necessary. The non-soluble base ingredients are carefully screened for freedom from toxicity, odor and taste. These must be properly compounded with antioxidants to obtain a base with the proper film strength to form a bubble and with long-lasting properties. This base is kneaded with the sugar solubles and flavor in large open mixers with careful time and power control to produce the uniform product so necessary for sensitive high speed wrapping machines.

Strict quality control of all raw materials is maintained. Raw materials and goods in process are examined by inspectors for adherence to quality standards and finished goods are tested for uniformity. Laboratory machines for chewing samples of gum have been attempted but none equal the differentiation supplied by the jaws of a person. Moreover, there are those bubbles. Not the least of the duties of the laboratory personnel and a test panel is that of "forever blowing bubbles."

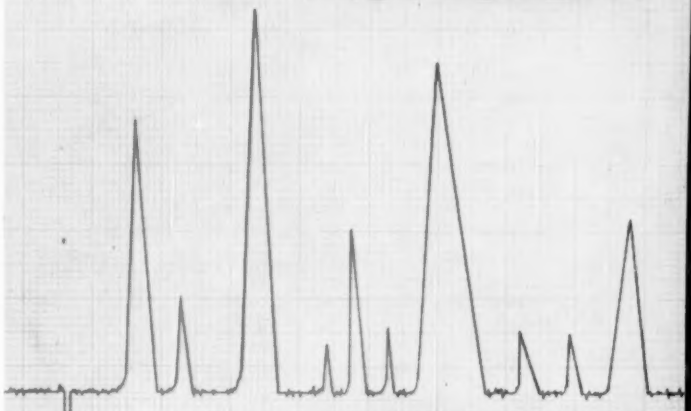
They Have a Product for Every Phase of Food Production and Processing

Through its farm chemicals, additives, and packaging materials, **E. I. Dupont de Nemours & Company,** Wilmington, Delaware, can take credit for a part of the enormous productivity of the American farm and also for many improvements in processed foods. These can be documented by product success stories too numerous to recount. Dupont's dithiocarbamate fungicides increased the yield of Anjou pears, grown under the shadow of Mt. Hood, in Oregon, by 300,000 boxes per year. Arasan seed disinfectant made it possible to use hybrid corn and to develop the high yields of today, 45.4 bushels to the acre (national average). Dupont farm chemicals, for example, nitrogen, have helped to retain the fertility of American soils while making possible the highest yields in Agricultural history.

With regard to food processing, Dupont has an equally great record. Dupont's Zytel, a nylon resin, is used for piping milk and also for conveyor chain links. One of its great advantages is that it needs no lubrication. Dupont's Teflon has solved many of the problems of flow in food processing equipment. Contributions to the betterment of food include Darvyl, L-lysine monohydrochloride, which, added to bread and other cereal products based on wheat, doubles the protein quality of these lysine-deficient products; Cylan, sodium cyclamate, an artificial sweetening agent that has about 30 times the sweetening power of sugar but contributes no calories to the diet and is widely used in dietetic foods; Mycoban (sodium or calcium proprionate) is an improved mold and rope inhibitor for use in bread and cereal products.

Dupont's food-packaging films are numerous but perhaps the one that has arrested the greatest attention is Mylar polyester film. "Boil-in-the-bag" films, a new concept in frozen food packaging, were difficult to achieve. The answer was found in Mylar laminated to polyethylene and fabricated into a pouch. In another form Mylar has come into wide use to package hams. This tough film heat-shrinks to provide a skin-tight fit that excludes air from the ham and helps preserve the flavor. Mylar is strong enough to withstand the rigors of shipping and handling.

MAN and INSTRUMENT



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To round out the picture, Evans Research offers its Pilot Consumer Panel for product evaluation. The keen observations of these *scientifically trained* homemaker-consumers provide unique, fast, and valuable results.

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They Sell Cellophane

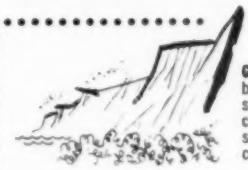
Cellophane, product of the **Avisco Film Division of the American Viscose Corporation,** has caused a major marketing revolution that shows no signs of diminishing. Since the early 'thirties there has been a dramatic change in America's shopping habits. Each year you select more and more products directly from store shelves and save time and money by taking your packages to checkout counters. This kind of marketing requires special packages and cellophane fills many requirements of the ideal package. It attracts because of its sparkle; it allows inspection of contents; it provides substantial and sanitary protection for the goods it wraps.

Uses for cellophane are varied, but about three-fourths of it goes into food packaging, with baked goods representing the largest portion. Meats, candy, gum, potato chips and snack items, and fresh fruits and vegetables are other large food categories. To serve all of these needs, the Avisco Film Division has developed more than fifty different types of cellophane. Each one fills certain basic requirements of the product being packaged.

Besides appealing to the shopper with its crystal clear transparency and with its high protective qualities, cellophane offers many advantages to manufacturing and processing firms. To illustrate, cellophane is the best film to use on packaging machinery—it is smooth and static-free, and can zip through automatic equipment at tremendously high speeds to give excellent packages at low cost.

MEER

...for gums of all types specially processed for the food industry



GUM CARAGEEN... used as a stabilizer, emollient, demulcent; offers some emulsifying action. For ice cream, chocolate milk, creamed soups, syrups, sherbets, whipped cream.

GUM ARABIC... its uses depend upon its action as a protective stabilizer, the adhesiveness of its water solutions, and as a thickener. Common in citrus oil emulsions, flavor emulsions, spray dried flavors, candies and jellies.

GUM GUAR... an extremely versatile gum, Guar is used as a suspending agent, viscosity modifier, stabilizer, dispersant, selective flocculant. For cheese spreads, ice cream, salad dressings and sauces, desserts, processed meats.

For more information on these and other water soluble gums that Meer Corporation has assembled, assayed, processed and distributed since 1926, write for descriptive technical bulletin.

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After serving as a military food packing material and as a component of gas capes during World War II, cellophane came back home to aid the growth of self-service selling, a trend that is a part of almost every retail merchandising plan today.

It was in 1946 that two companies, both with products of regenerated cellulose—American Viscose Corporation, the nation's largest rayon manufacturer, and Sylvania—merged to form a diversified and stable chemical processing organization. A year later a major expansion was undertaken at Fredericksburg, Virginia, to boost cellophane manufacture to meet increasing demands for this versatile film. In 1955 Sylvania cellophane, then a long-respected name in the packaging field, adopted the Avisco name and became an important and fully integrated teammate with other American Viscose products.

Marcus Hook is the home of America's newest cellophane plant. It had its earliest settlers in the seventeenth century when it was a small Swedish colony known as Maarte's Hook. The area passed to English rule shortly thereafter and in the 1690's it received its charter from William Penn, making it Pennsylvania's third oldest town.

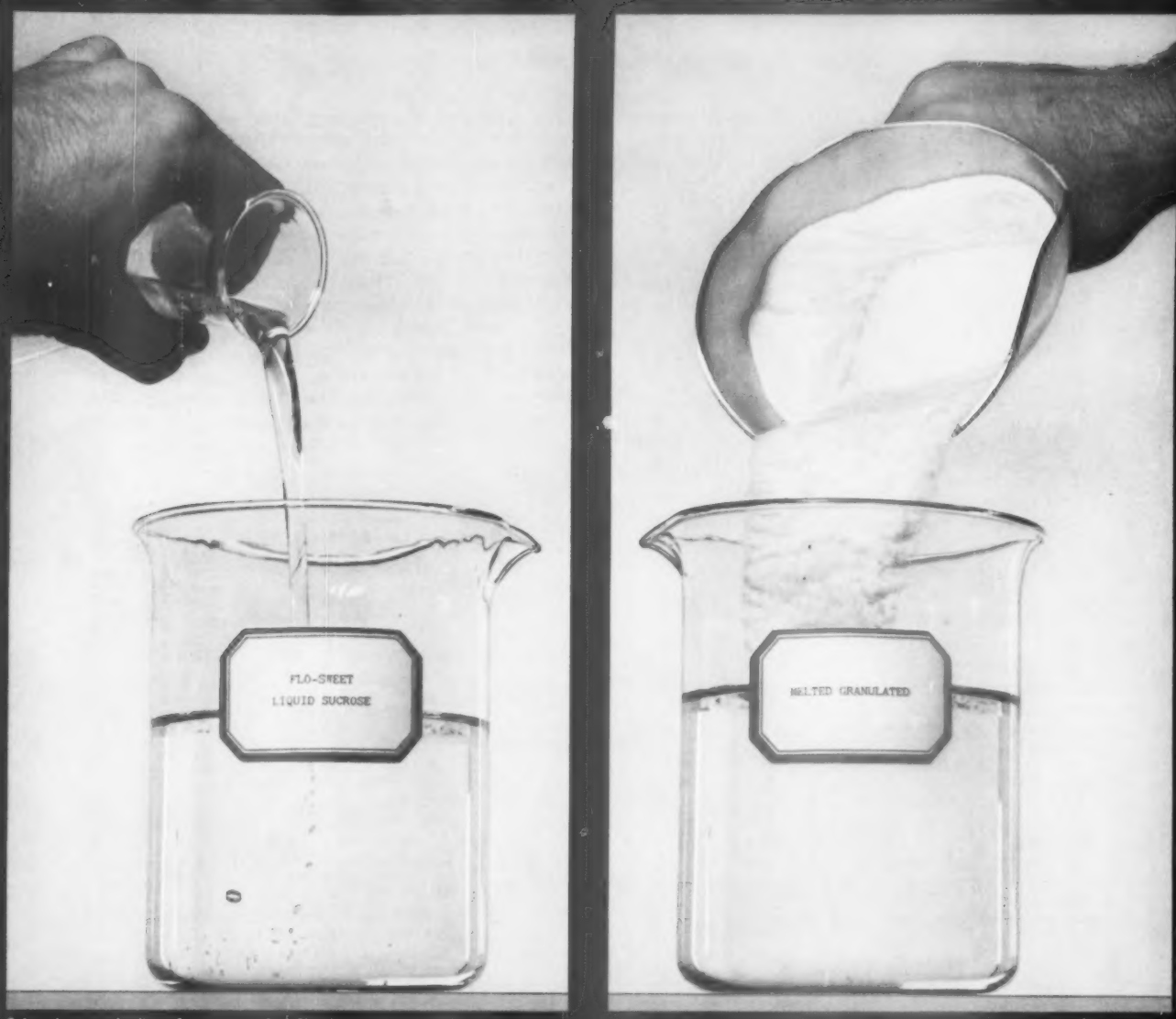
They Created an Industry

To have "created an industry" is a statement few companies in the world can rightfully make. In the food and feeding industry one company which can make the statement with complete authority is **Rudd-Melikian, Inc.**, Hatboro, Pennsylvania, creators of Kwik Kafe liquid coffee concentrate and the original coin-operated coffee dispensing machine.

Rudd-Melikian was founded in 1947 as the result of an idea born in 1946 of annoyance with army regulations and made workable by two friends, Lt. Lloyd Rudd and Sergeant K. C. (Cy) Melikian. Thwarted in an attempt to get a between-meals cup of coffee from the cafeteria at Wright Field where they were stationed, they wondered out loud why someone didn't come up with a coin-operated machine to give a man a hot cup of coffee anytime he wanted it. Both engineers, they pursued the idea in off-duty hours, tinkering and experimenting with what spare parts they could appropriate. Upon discharge they pooled limited resources, set up their first shop in a Philadelphia garage, and turned out their first machine.

The machine was an instant success at a football game, but dissatisfaction with the quality of commercial powdered coffee then available led the young partners to develop Kwik Kafe, a pure liquid concentrate brewed from a blend of roasted coffee beans, shock-frozen to trap the full flavor, and reconstituted in the machine a cup-at-a-time at the drop of a coin. Today, with coffee and tea concentrate prepared under the direction of Rudolph Dornseifer, Vice President, approximately 35,000 of these machines serve more than 1 million cups of hot beverage daily in many corners of the world.

Success in their created field of automatic coffee dispensing, coupled with unlimited faith in the future of food vending, last year led Rudd-Melikian to pioneer in still another direction—"in plant" serving of complete meals by vending machines. Now on trial in a plant of the AC Spark Plug Company, Flint, Michigan, are a battery of Rudd-Melikian machines



Color plates made direct from unretouched Ektachrome transparencies

TALK ABOUT SUGAR

The sparkling white crystals of granulated sugar have long been regarded as an informal standard of purity. But when dissolved in water, they show a certain amount of color. And color is one indication of sugar purity.

Today's quality liquid sugars far exceed many of the accepted specifications for granulated. A further practical consideration is that even the water in many liquid sugars is refinery purified.

For more than a quarter century Flo-Sweet has been the pioneer in the development of truly top quality liquid sugars. As the photograph on the left shows, Flo-Sweet today is so pure that it is hardly distinguishable in color from distilled water!

With today's trend toward higher and higher quality, only the best ingredients are good enough for the discriminating food producer. We invite you to compare Flo-Sweet with any other sugar, liquid or granulated, on any basis that you choose: color, taste, or laboratory analysis. We believe you will be impressed by the results.

For this is true sugar quality. You can *see* the difference.

FLO-SWEET

FIRST IN LIQUID SUGAR

REFINED SYRUPS & SUGARS, INC.

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which vend to more than 1,000 employees a choice of hot platters, cold platters, sandwiches, soup, pastries, and fresh milk in a cup—in addition to coffee, tea and hot chocolate.

Manufacture of the hot platter machines has launched Rudd-Melikian in yet another venture—the preparation of the platters themselves. This new phase of operations is carefully guided from a quality control standpoint by Dr. Stanley Segall, Director of Research. All of the 32 hot platter combinations—each consisting of a meat or fish dish and two vegetables are prepared, packaged in their individual aluminum containers and frozen for shipping under highest sanitary conditions.

They Make Dryers

Proctor & Schwartz, Inc., through the facilities of their testing laboratory in Philadelphia and through the use of portable test drying equipment, has participated in dehydration investigations for many years. The successful analyses of many problems involving the various products of many customers have resulted in commercial installations yielding dehydrated products of high quality with economical operation.

Proctor's continuous dryers as applied to the drying of food products are of two general types. Basically they are conveyor dryers and spray or dispersion dryers. Yeast, starch, onions, cereals, gelatin, and coffee are a few of the products produced in continuous processing lines.

The conveyor dryers are employed on materials, which in their wet state are so prepared that the wet product, as it is fed to the conveyor of the continuous dryer, allows a pervious bed of material to be distributed uniformly across the width of the conveyor. Heated air at controlled temperatures is then recirculated through the material on the conveyor and uniform rapid drying attained.

The other type of continuous dryer is the spray dryer, a modification of which is termed a dispersion dryer. In these types of dryers, such as employed in the drying of instant coffee, instant starch, extract flavorings, etc., the product is initially produced in the wet process as a slurry or dispersable wet solid.

MICHAEL'S INSTANT VANILLA CRYSTALS

with the full flavor and aroma of the vanilla beans from which they are made!

Michael's Instant Vanilla Crystals are free-flowing and instantly soluble.

Michael's Instant Vanilla Crystals are made with a sugar base, are completely stable, and will retain their flavor and aroma for long periods under all conditions.

Michael's Instant Vanilla Crystals are made by a low temperature process, with no loss of true vanilla aroma. Also available with added vanillin.

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FUTURE MEETINGS FOR FOOD TECHNOLOGISTS

April 20-21	Society of Soft Drink Technologists Annual Meeting, Statler Hilton Hotel, Washington, D.C.
April 20-22	American Oil Chemists Society Spring Meeting, Roosevelt Hotel, New Orleans, Louisiana
April 28-May 1	Annual Convention of the Institute of Food Technologists, Australia, Mayer Chalet, Warburton, Victoria
May 17–21	**Nineteenth Annual Meeting of the Institute of Food Technologists, Bellevue-Stratford Hotel, Philadelphia, Pennsylvania**
June 7-11	76th Annual Convention of the National Confectioners Association, Conrad Hilton Hotel, Chicago
June 7-11	76th Annual Convention of the National Confectioners Association, Conrad Hilton Hotel, Chicago
June 9-13	Second Inter-American Food Congress, Carillon Hotel, Miami Beach, Florida
June 9-13	Second Inter-American Food Congress, Carillon Hotel, Miami Beach, Florida
June 10-12	Second International Symposium on Gas Chromatography, Kellogg Center, East Lansing, Michigan
June 10-12	Second International Symposium on Gas Chromatography, Kellogg Center, East Lansing, Michigan
June 11-12	Canadian Institute of Food Technology, 2nd National Conference, Royal Hotel, Toronto
June 15-Sept. 4	Gordon Research Conferences, Colby Junior College, New London, New Hampshire
August 19-26	10th International Refrigeration Congress, Copenhagen, Denmark

1960	
May 15-19	**Twentieth Annual Meeting of the Institute of Food Technologists, Fairmont Hotel and Masonic Temple, San Francisco, California**
1961	
May 7-11	**Twenty-first Annual Meeting of the Institute of Food Technologists, Hotel Statler, New York, New York**
1962	
June 17-20	**Twenty-second Annual Meeting of the Institute of Food Technologists, Amercana Hotel, Bal Harbor, Miami Beach, Florida**

An open invitation is extended to readers of FOOD TECHNOLOGY to send in to the Editorial Office, 11606 South Bell Avenue, Chicago 43, Illinois notices of annual or national meetings of interest to food technologists.

Of Professional Interest

Paul J. Cupp to Keynote Nineteenth Annual IFT Meeting in Philadelphia

Literally born into the retail food business, Mr. Paul Cupp who will address the opening session of the Philadelphia meeting of IFT, has been active in it all his life. His father had a general store in Johnstown, Pa., which, after eliminating shoes, notions, dry goods, etc., from the line of goods carried, became a food store. His early experience in the food business included driving the delivery wagon, weighing the many items, which at that time came in bulk, and waiting on the trade. Eventually, the elder Mr. Cupp opened other stores and, in time, a warehouse. Thus, his son gained experience as store manager, truck driver and warehouseman. While attending the Wharton School of the University of Pennsylvania, he became interested in the tabulating control of chain grocery warehouses and was responsible for installing the tabulating system in the Cupp Grocery Company.

Paul J. Cupp

On January 1st, 1929, the Cupp Stores became a part of the American Stores Company and Mr. Paul J. Cupp joined ASCO as a grocery buyer for Johnstown Zone. He became Zone Manager on February 1st, 1931, and served in that capacity until April, 1935. After almost two years in the Philadelphia office, Mr. Cupp became Zone Manager of North Jersey with headquarters in Orange, N. J. The growing demands of the business made larger warehouse facilities necessary and, early in 1941, Kearny warehouse was opened with greatly enlarged floor area and zone headquarters moved to the new building. Mr. Cupp controlled the operation in North Jersey until he was chosen assistant to Vice President Williams Eden on September 4, 1951 which necessitated his moving to the Philadelphia area. Upon the retirement of Mr. William Eden in June, 1952 Mr. Cupp was appointed Vice President in charge of Buying, Advertising and Merchandising. At a meeting of the Board of Directors on June 15, 1955, Mr. Cupp was chosen to succeed Mr. William Park as President of the American Stores Company.

The Publicity Committee for the Philadelphia meeting have put in a great deal of effort to let the food world know that an important event is pending in May—the 17th to the 21st—in Philadelphia; namely, the Nineteenth Annual Meeting of the Institute of Food Technologists. Shown above, left to right, are Marcell Labbee of Rohm and Haas Co., Charles McLaughlin of Atlas Powder Co., Hugh Scott, Philadelphia Inquirer, and Charles Trombold, Campbell Soup Co. The photograph was taken by Duncan Macpherson at the Poor Richard Club, Philadelphia, at a recent meeting of the Committee. Center of interest is an article on the IFT meeting and food processing in the Philadelphia area. The article is destined for publication in Today's Magazine, Sunday supplement of the Inquirer.

Third Nomography Competition Announced

The Engineering Graphics Division of the American Society for Engineering Education (Committee on Nomography) announces the Third Nomography Competition for the best nomograph published in the period January 1 to December 31, 1958. Convair of San Diego, California, provides a prize of $100 to the winner and the award citation will be made at the Annual Meeting of the Society in Pittsburgh in June. Authors of Food Technology or Food Research articles wherein nomographs appear are invited to submit the reference, author, journal, issue number, date, page but *not the nomograph* to J. N. Arnold, Nomography Committee, Golden Laboratories, Purdue University, Lafayette, Indiana. Nomographs from other journals are of course also eligible for entry. Submit only the reference, however.

(Continued on page 25 following technical section)

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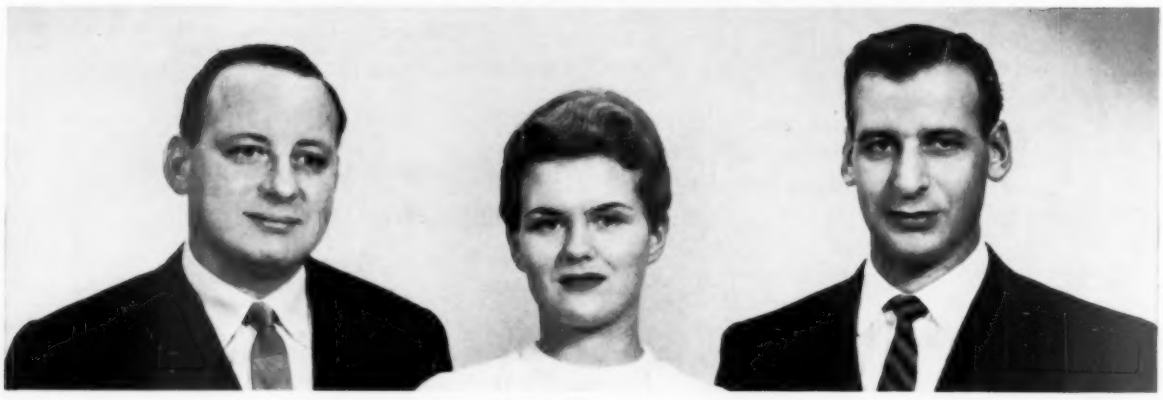
your low calorie foods...



to their taste

Special dietary requirements, whether of vanity or health, must perforce be the primary consideration of the food processor selling this market. But whatever the problems of the manufacturer, they should never be apparent in the finished product. D&O has done extensive work in the flavoring of dietetic and low calorie foods and beverages and will be happy to place this experience at your service. Inquiries are invited.

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Time-Temperature Tolerance of Frozen Foods. XVII.

Frozen Fried Chicken

Helen L. Hanson, Lorraine R. Fletcher, and Hans Lineweaver

Western Regional Research Laboratory,[a] Albany, Calif.

(Manuscript received July 29, 1958)

STUDY OF THE STABILITY of commercially prepared frozen fried chicken was undertaken because of the popularity of fried chicken and because tests on laboratory-prepared samples showed it to be considerably less stable than other cooked frozen poultry products *(1, 3)*. The study was designed to determine (a) whether rate of flavor change is approximately the same in fried chicken from different sources (and thus relatively independent of usual processing or formulation variables), (b) types of flavor changes that occur, (c) conditions that produce sufficient off-flavor development to cause consumer dissatisfaction, (d) conditions under which fried chicken can be held with little or no flavor changes, and (e) methods of increasing shelf life.

METHODS

Frozen, cut-up, fried chicken was obtained from 2 commercial sources. Chickens from both lots weighed approximately 2 lbs. Lot 1 included all edible parts of the chicken; livers were omitted from Lot 2. The coating of Lot 1 consisted of wheat flour, potato flour, salt, and pepper; butylated-hydroxy anisole, propyl gallate, and citric acid in propylene glycol had been added. The coating of chickens of Lot 2, more of a batter type, consisted of flour, eggs, milk, salt and seasonings. Both lots were fried in vegetable oil.

Packaging consisted of a paperboard box laminated on both sides with aluminum foil with an overwrap of wax paper and foil laminate for Lot 1 and a waxed cardboard box with a single piece of paper over top, bottom, and 2 sides and an overwrap of cellophane for Lot 2.

Both lots of chickens were prepared and frozen just prior to shipment and were received in the frozen state. Control samples were transferred to No. 10 cans, nitrogen packed, and stored at −30° F. Samples to be compared were heated from the frozen state at 400° F. for 30 minutes.

Several types of comparisons were made to determine the effect of storage conditions on flavor changes. Two samples were compared at a time and all comparisons were made after 3 to 5 storage periods with 4 replications. Paired samples were served under sodium lights to a panel of 8 judges, experienced in detecting off-flavors in frozen poultry, who ranked the samples (1 = *least off-flavor*, 2 = *most off-flavor*) and checked staleness, rancidity, and other off-flavors. If more than one comparison was being made, the replications were randomized. Meat and skin (with coating) were tested separately. Liver was tested by 4 judges.

Peroxide values were determined on the dark meat and skin (with coating) separately at each temperature at intervals of 2 weeks or more by the method described by Pool *et al. (5)*.

Gas analyses (oxygen and carbon dioxide) were determined on all canned samples. The Orsat apparatus using potassium hydroxide solution for carbon dioxide absorption and chromous chloride solution for oxygen absorption was used *(6)*.

[a] Western Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

RESULTS AND DISCUSSION

Comparative rates of flavor change in fried chicken from different sources. Several storage conditions were used to determine whether different lots of chicken behave similarly under storage conditions that give different rates of deterioration. The temperatures were 20°, 10°, and 0° F. (−6.7°, −12.2°, and −17.8° C.) for chicken in an air atmosphere (the original retail packages and sealed cans) and 20° F. in a nitrogen atmosphere (sealed cans). Samples held under these conditions were compared with control samples held at −30° F. (−23.3° C.) in a nitrogen atmosphere after 3 periods to determine whether detectable flavor changes had occurred.

Off-flavors developed to approximately an equal extent in the 2 lots under the same storage conditions (Table 1). Off-flavors also developed at a corresponding rate in laboratory-prepared samples *(2)*. Since these lots represented different sources, processing equipment, coatings or dredges, and packaging materials, and also the presence and absence of antioxidants, it appears that storage condition is considerably more important in stability of frozen fried

TABLE 1

Comparison of off-flavor detection in frozen fried chicken from two commercial sources stored under equal conditions of time, temperature, and atmosphere

Temp. (° F.)	Atmosphere	Lot	Flavor different from control after following times (months)					
			½	1	2	3	4	6
			Meat					
20	air	1	*	*		*		
		2	*	*		*		
10	air	1		....		*		*
		2		....		*		*
0	air	1			*		*	*
		2			*		*	*
20	N_2	1		....		....		....
		2		....		....		....
			Skin					
20	air	1	*	*		*		
		2	*	*		....		
10	air	1		....		*		*
		2		....		*		....
0	air	1			....		....	....
		2			....		....	*
20	N_2	1		....		....		....
		2		....		....		....

* = significant (P = 5% or less) flavor differences between experimental and control (−30° F., N_2) samples.

.... = nonsignificant differences. Blank spaces indicate conditions not tested for both lots.

chicken than the other variables. The good correlation in results indicates that fried chicken from other sources will develop off-flavors at approximately the same rate under similar conditions.

Relative rates of flavor changes at −10°, 0°, 10°, and 20° F. The flavor changes in fried chicken were qualitatively the same as those observed in other frozen precooked poultry products *(3, 4)*. The first is loss of "freshly cooked" chicken flavor. This is followed by a "warmed over" flavor or slight staleness, and eventually an objectionable rancid flavor. The relative times for these changes to occur in chicken in the retail packages at 0°, 10°, and 20° F. (based on results in Table 1 and additional tests on Lot 1) are shown in Figure 1. The first tests were made after samples at 20° F. had been stored for one week, and those at 10° and 0° F. had been stored for a month. Because of intensity of off-flavor development, they were terminated for samples held at 20° after 3 months, at 10° after 9 months, and 0° after a year.

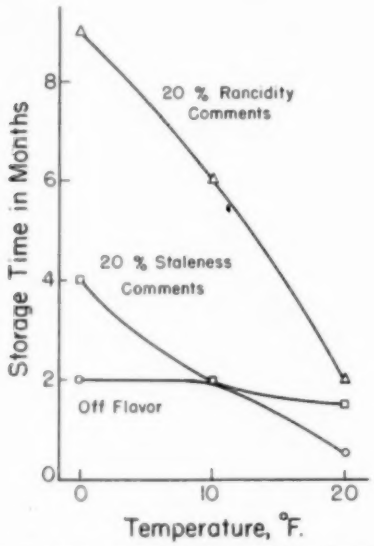

Figure 1. Relative times to indicated flavor change in fried chicken at 0°, 10°, and 20° F. in retail packages.

The times indicated for development of off-flavor are those at which significantly more off-flavor was detected in samples held at experimental temperatures than in controls at −30° F. in nitrogen. Staleness and rancidity are indicated when they were noted in 20 to 25% of the judgments. This proportion of the judgments was selected because it corresponds to the beginning of a consistently increasing number of adverse comments. The comments, since they were voluntary, have less significance than the detection of flavor differences between controls and experimental samples. However, they aid in interpretation of differences.

Limited tests on samples stored at −10° F. showed a detectable flavor change and staleness comments at the above levels after 4 to 5 months but only random comments on rancidity after a year.

Direct comparisons between samples of Lot 1 stored in retail packages were made to establish quantitatively the effect of 10- and 20-degree differences in the range of −10° to 20° F. (20° vs. 10° F., 20° vs. 0° F., etc.) on flavor changes. It is expected that a 10- and a 20-degree temperature difference will not produce the same result independently of temperature level. The results (Table 2) show that the 10-degree differ-

TABLE 2

Times for development of detectable flavor differences between commercial fried chicken samples stored at temperatures differing by 10° or 20° F.

Chicken parts tested	Time (months) required to produce off-flavor differences for following conditions:				
	10-degree difference			20-degree difference	
	10° vs. 20° F.	0° vs. 10° F.	−10° vs. 0° F.	0° vs. 20° F.	−10° vs. 10° F.
Meat	1.5	12	12	1	9
Skin	2	>12[2]	12	3[1]	9
Liver	1.5	>4[3]	>9[2]	1	4

[1] Difference not significant after 1½ months, no comparison at 2 months.
[2] No comparisons were made after 12 months.
[3] Liver stored at 10° and 0° F. was not tested after 4 and 9 months, respectively, because of objectionable off-flavor.

ence between 20° and 10° F. causes a flavor difference in fried chicken meat in 1.5 months, whereas the difference between 0° and −10° F. does not cause a flavor difference until 12 months. The difference between 20° and 0° F. resulted in a flavor difference in 1 month, but between 10° and −10° F. only after 9 months. Obviously if this product were used within 6 months, it would be as acceptable if held at 10° as at −10° F. However, 10° F. would not be a good temperature for normal distribution because the product held at 10° F. would undoubtedly occasion consumer complaints sooner than the one held at −10° F. On the other hand, these data indicate that when storage time is controlled, as is possible in an integrated restaurant or airline operation, a temperature above that required for longer holding may be satisfactory. Table 2 should not be interpreted as showing no flavor deterioration; the results show when flavor changes, which are occurring in both samples of a comparison, are distinguishable. That distinguishable differences occur in about the same times for the intervals −10° to 0° and 0° to 10° F. is somewhat surprising.

Tasting of livers stored at 10° and 0° F. was discontinued after 4 and 9 months, respectively, because of objectionable off-flavor development. This rapid deterioration in frozen cooked liver makes their use in precooked frozen products questionable.

As reported for other products in this series of studies, no difference was detected in flavor or peroxide values between fried chicken stored 9 months at temperatures fluctuating in a sine wave cycle over a 24-hour period from 0° to 20° F. (product temperature range approximately 1° to 19° F.) and samples stored at a constant temperature of 10° F.

Skin and meat were evaluated separately. Flavor changes were slightly more rapid in meat than in skin and coating. Of the 70 tests (24 judgments each) on both lots of chickens, significant flavor differences

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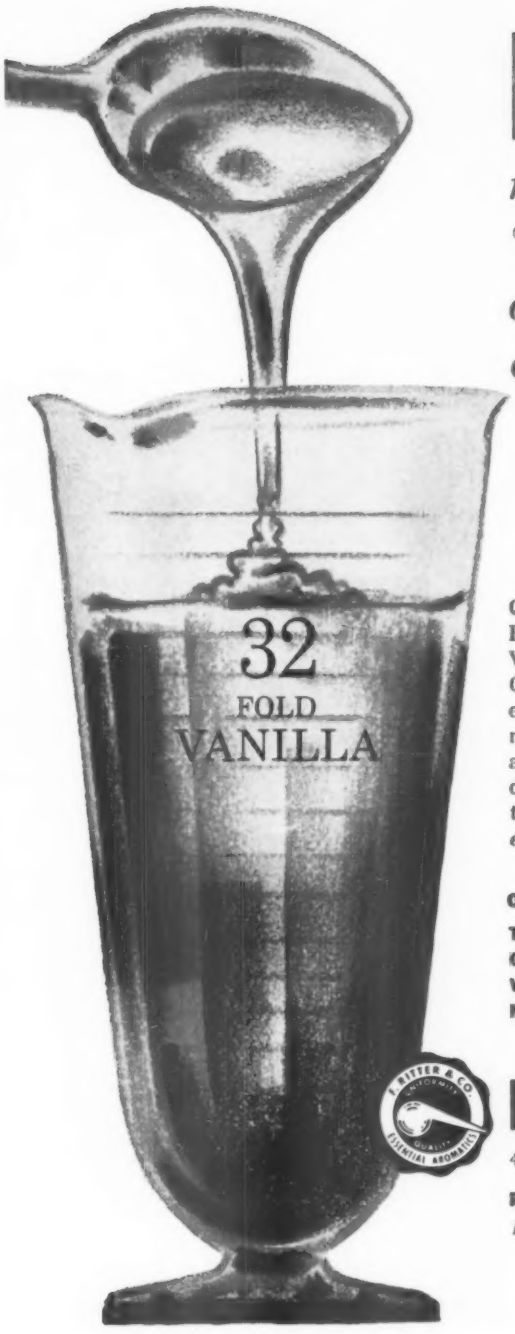

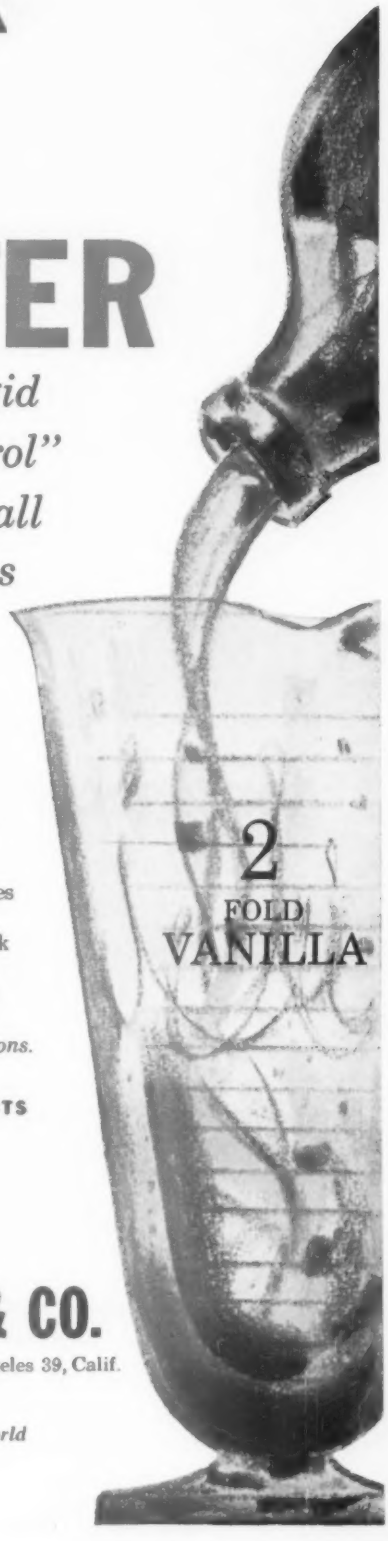

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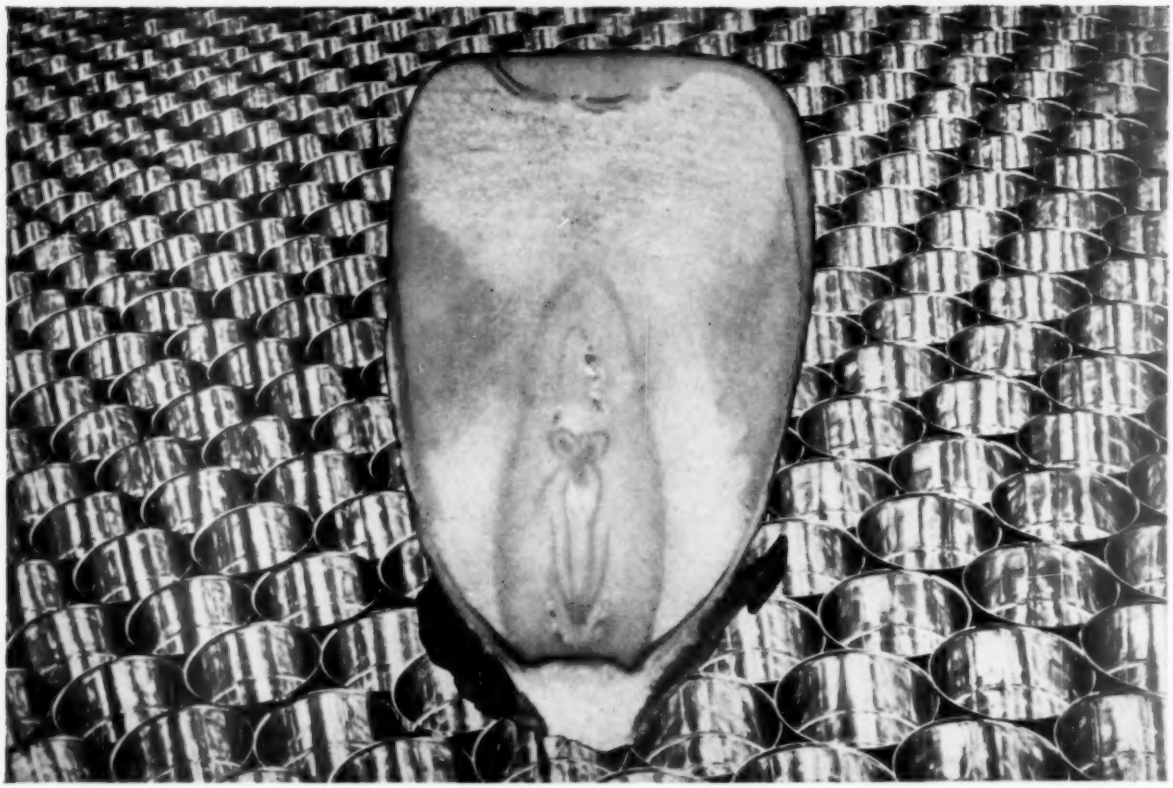

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(5% level of probability) were found in the meat in 32 and in the skin in 25 tests and, of these, highly significant differences (1% level of probability) were found in the meat in 21 and in the skin in 10 tests. Whether this difference indicates slightly more off-flavor in the meat than in the coating or whether the off-flavor is more difficult to detect in the coating because of the seasonings and possible non-uniformity of application is not certain. Evidence in support of greater flavor change in the meat, however, is obtained from the peroxide values, which were higher in the meat. In any case it is important that the flavor of the meat itself changes, and instability problems are not those of the frying fat or coating alone.

Peroxide values and oxygen uptake. Figure 2 shows the greater peroxide development in fat from the meat than in that from the skin and coating. The general trend of increasing peroxide development with longer times and higher temperatures agrees in general with the rancid off-flavor development detected by the panel of judges. The periods at which comments on rancid off-flavor were made in 20% of the judgments are indicated by arrows on the curves. These points correspond to peroxide values of approximately 8 at 20° and 10° F. and 5 at 0° F. Thus low peroxide values such as these do not necessarily indicate absence of detectable rancid off-flavor.

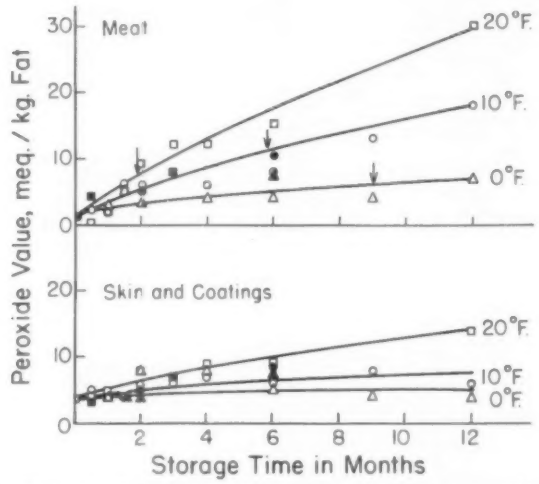

Figure 2. Influence of time and temperature on peroxide value of fat in frozen fried chicken. (Lot 1 shown in open symbols; Lot 2, solid symbols. Arrows indicate points at which rancidity comments were made in 20% of the flavor judgments.)

Oxygen uptake was determined on chicken stored in No. 10 hermetically sealed cans. The volume of air surrounding the chicken was approximately 2,240 ml. Oxygen uptake increases with increasing temperature from 0° to 20° F. (Figure 3). Arrows on the curves indicate oxygen uptake at the 3 temperatures after times required for equal rancidity comments by the judges. These show that uptake at 20° and 10° F. was 0.07 to 0.08 ml. per gram and at 0° F. approximately 0.05 ml. Thus, both peroxide values and

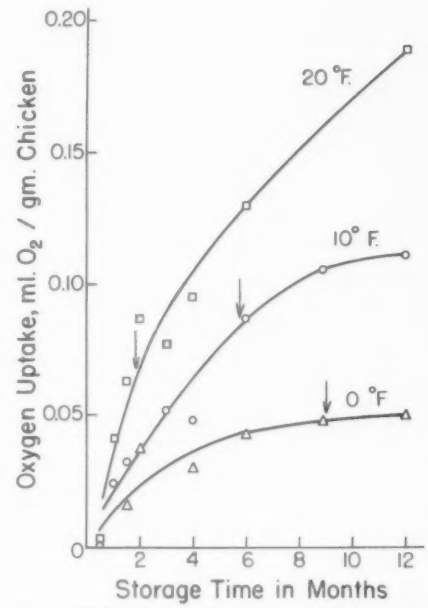

Figure 3. Influence of time and temperature on oxygen uptake by frozen fried chicken, Lot 1. (Arrows indicate points at which rancidity comments were made in 20% of the flavor judgments.)

oxygen uptake are approximately equal at 20° and 10° F. for approximately equal rancidity development, but both are lower at 0° F. The total oxygen content in the cans held under the most severe storage conditions (20° F. for 1 year) was reduced from 21 to 14%.

Increased stability obtainable with inert atmosphere. Use of an inert atmosphere virtually eliminates development of a rancid flavor in frozen fried chicken (Table 3). Although slight staleness was detected at all temperatures tested after 3 to 6 months, it is probably not sufficient to be apparent to most consumers.

TABLE 3

Influence of inert atmosphere in retarding flavor change in frozen fried chicken meat

Storage temperature °F.	Time (months) for development of flavor change			
	Off flavor[1]		Rancidity[2]	
	N_2	Air	N_2	Air
20	12	0.5	>12	2
10	>12	2	>12	6
0	>12	2	>12	9

[1] Off-flavor is indicated at time when flavor differences between experimental samples and controls (−30°, N_2) were distinguished at statistically significant levels.

[2] Rancidity is indicated at times when it was recognized and noted in 20 to 25% of the judgments.

SUMMARY AND CONCLUSIONS

The flavor stability of commercially prepared frozen fried chicken has been determined for storage temperatures from −10° to 20° F. in the original retail packages and in hermetically sealed cans with either

air or nitrogen atmosphere, for periods from 2 weeks to a year. The rate of flavor change was found to be approximately equal in fried chicken from two commercial sources and also in a laboratory preparation studied previously. Flavor changes were detected more readily and peroxide values increased more rapidly in the meat than in the skin and coating, indicating that flavor instability is as serious in the meat as in the outer coating, if not more so.

Since rancid off-flavor was the most serious flavor change detected, the effects of storage in an inert atmosphere were studied. Rancidity ,which was detected after 2 months in samples stored at 20° F. in commercial containers, was not detected even after 12 months in nitrogen-packed samples at 20° F. It was detected in 6 months, however, in commercial samples (not nitrogen packed) held at 10° F. and in 9 months at 0° F.

The fairly rapid rate of flavor change in frozen fried chicken indicates the need for low temperatures (0° or −10° F.) and short storage times (6 months or less) unless it is packed in an inert atmosphere.

Acknowledgment

The authors wish to thank the Refrigeration Research Foundation for most of the experimental samples, Iva Streeter for peroxide determinations, and M. F. Pool for assisting in gas packing and analysis.

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Rapid Determination of the Quality of Whole Eviscerated Haddock[a,b]

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(Manuscript received May 31, 1958)

Fish and fishery products constitute an important source of protein of excellent nutritional quality. The fishing industry, however, needs an objective method or methods for evaluating the freshness of fish. At least two types of decomposition take place in fish; namely, changes resulting from the growth of bacteria and autolysis caused by tissue enzymes. Autolysis would be of minor importance except that it may cause softening of the tissues and a corresponding deterioration of texture. Tests have been devised to detect autolysis. Bacterial action is more often the cause of a loss of quality in fish than autolysis. Many tests for freshness have therefore been based on the determination of bacterial end products.

Reay and Shewan *(5)* stated that the most useful and reliable test for grading of quality in fish are tests for trimethylamine and dimethylamine content. Dyer *(3)* developed a simple colorimetric test for the estimation of trimethylamine.

Volatile bases such as trimethylamine and dimethylamine are not suitable criteria for quality, however, in all species of salt water fish. Even in fish of the cod family there may be variations in the amount of these bases present in the flesh of fish equivalent in quality because of differences in size or in other factors.

Stroheker, Vaubel, and Kerchberg; and Lang, Farber, Beck, and Yerman *(4, 7)* found volatile reducing substances to be a suitable criterion of quality in fish. The fact that this test is time consuming and requires

[a] Contribution No. 351 from the Department of Food Technology.
[b] Presented at the Eighteenth Annual Meeting of the Institute of Food Technologists, Chicago, May 27, 1958.
[c] Present address: The Boeing Co., Seattle, Washington.

rather complex equipment has limited its application.

Amano and Utiyama *(1, 2)* used mercuric chloride solutions to precipitate certain compounds from an aqueous extract of fish muscle and thus indicate quality. This method was found to be impractical with shark, cuttlefish, or squid but to be useful in estimating the freshness of tuna.

Other freshness tests that have been proposed include measurement of surface pH for fillets *(9)*, determination of the firmness of fish flesh *(8)*, and electrometric titration of fish flesh *(6)*. Most of the tests proposed are not considered, for one reason or another, to be entirely suitable as indices of the quality of fish.

This paper is concerned with a method that has been developed for the rapid determination of the quality of whole, eviscerated haddock.

EXPERIMENTAL

Storage tests with haddock were carried out in the following manner: A quantity of whole eviscerated fish, usually 150 pounds, was purchased from a local fisherman. These fish, when brought to the laboratory, had been held for less than 24 hours after being caught. Some of these fish were still sufficiently fresh to show signs of rigor. The fish were placed in ice in a metal tank fitted with wooden racks in order to separate each 3 layers of fish and ice so that none were subjected to much pressure. Approximately 100 pounds of crushed ice was used with each 150 pounds of fish. The tank was drained through holes in the bottom so that water from melting ice could not accumulate around the fish. The tank with fish and ice was held in a refrigerator room (36–40° F.). This provided a temperature of 33–34° F. around the fish held in the tank.

For some tests, haddock that were purchased in a strictly fresh state were placed in MSAT cellophane bags and held at temperatures of 36–40° F.

A representative number of fish, usually 6, were removed from different areas of the tank each day and tested. The eyes were cut from the head of each fish and placed in a 100-ml. beaker. A slit was then made in the posterior part of each eye, and the fluids were allowed to drain into the beaker. Fluids from the eyes of each fish were kept separate, and each lot was transferred to centrifuge tubes and rotated in a chemical centrifuge. The clear liquid fraction was then strained through a thin mat of glass wool further to remove a gel-like component.

Refractive indices were determined on the clear eye fluid at 20° C. using an Abbé refractometer. Only 2 to 3 drops of the fluid were required for this test.

To determine the optical density of the centrifuged eye fluids, a 2-ml. portion was placed in a lumetron tube and diluted with 8 ml. of Beckman No. 3501 pH 7 buffer. The optical density was measured in a lumetron colorimeter at a wavelength of 420 mμ. Distilled water was used as the blank.

In making organoleptic tests, the fish were filleted and cut into 50-g. portions, using only the middle section of each fillet. The portions of fish were placed in crystallizing dishes and covered with inverted crystallizing dishes of larger size. These were placed in an electric oven at 400° F. and cooked for 20 minutes.

The organoleptic test panel consisted of 5 members, each of whom had received training at the East Boston Laboratories of the U. S. Department of the Interior in determining the characteristics of cooked fish of different degrees of freshness.

Within 5 minutes after the different samples of fish had been cooked, they were evaluated in accordance with the scoring sheet (Figure 1). The individual scores for any criterion and total scores calculated according to weighted values (total score 100 for a perfect sample; odor valued at 35 and divided into 6 categories, flavor valued at 30 and divided into 7 categories, texture valued at 25 and divided into 3 categories, appearance valued at 10 and divided into 3 categories) were used to determine the degree of correlation with the two tests previously described.

Figure 1. Organoleptic score sheet.

Test	Rating	Evaluation	Sample
Odor	6	Fresh (typical for this species)	
	5	Flat (lacking odor)	
	4	Slight T.M.A. (slightly fishy)	
(35%)	3	Strong T.M.A. (strongly fishy)	
	2	Ammoniacal	
	1	Putrid	
Flavor	7	Excellent palatability	
	6	Good acceptable	
(30%)	5	Fair marketable	
	4	Neither like nor dislike	
	3	Barely palatable	
	2	Poor, not marketable	
	1	Bad, offensive	
Texture	3	Very firm	
(25%)	2	Fairly firm	
	1	Soft	
Appearance	3	Bright, glossy, moist	
(10%)	2	Less glossy, less moist	
	1	Chalky appearing	

Comments:

No organoleptic tests were made in the case of fish held at 36–40° F. without ice.

For bacteriological media, a fish-extract agar was prepared by dissolving 25 g. of tryptose glucose extract agar in a fish extract. The fish extract was prepared by boiling 1 pound of haddock flesh in 1 liter of water for 1 hour, filtering, autoclaving for 10 minutes at 20 lbs. pressure, again filtering, and making up to a volume of 1 liter. The culture medium was finally sterilized in the usual manner.

In making bacteriological tests on fish-eye fluids, one eye was removed from the fish, washed with 80% ethyl alcohol and pierced with a scalpel. A pipette was inserted, 1 ml. of eye fluid was withdrawn and diluted with 9 ml. of sterile water. Further dilutions were prepared from the 1:10 dilution. All equipment used for such tests was sterile. The various dilutions of eye fluids were cultured in Petri dishes, using the fish-extract agar medium, and cultures were incubated for 5 days at 20° C. before counts were made.

Trimethylamine nitrogen determinations were made on fish-flesh samples according to the method described by Dyer *(3)*.

To obtain values for the refractive index and optical density values for the eye fluids of fish immediately after removal of the fish from the water, an investigator participated in an 8-day fishing trip aboard a commercial dragger. The tests indicated were made on fish immediately after removal from the water and at 3-, 6-, and 8-hour periods after removal from the water.

DISCUSSION

When tests were being considered for determining the quality of fresh fish, it was concluded that such a test should be made on some portion of the carcass not subject to factors such as size, use of test materials subject to the leaching effect of water or ice, or other variables that might present a misleading picture.

If these variables were to be eliminated, the portions of the fish affording the most promising possibilities might be the gills or the eyes. It was decided that the eye of the fish would best meet the requirements of a test for quality.

With good, bad, and indifferent fish, it was noted that there were changes in the refractive index and optical density of the centrifuged eye fluids. It also was noted that during the first few days that the fish

were held in ice, the eye fluids were clear. As storage continued, these fluids became yellow, the intensity of this color increasing until that period of storage at which blood was liberated in the eye fluids, in which case the yellow color was masked by the red color of the blood.

The yellow component of fish eye fluids appeared to be proteinaceous in nature or to be combined with a protein, since it could be precipitated by protein coagulants. The only solvents found for this material were pyridine and methyl alcohol. An attempt was made to identify the yellow compound. It was found not to be one of the following: carotene, astacene, xanthophyl, and a greenish hydrocarbon, which have been associated with the retinal pigments of the eyes of certain animals.

A series of tests were started to determine the refractive index and optical density of eye fluids and the trimethylamine content and organoleptic quality of haddock flesh that were stored at 33–34° F. The scoring sheet used by the taste panel is shown in Figure 1.

Best results were obtained with the refractive index measurements on eye fluids, which showed a curvilinear relationship with the time of storage. Comparison of the data is given in Figure 2 and Table 1.

TABLE 1
Cofficient of correlation of refractive index with over-all score, flavor and odor

Storage run	Over-all score	Flavor	Odor
First run	−0.95	−0.71	−0.96
Second run	−0.92	−0.60	−0.56

Regression analysis of the refractive index versus organoleptic rating is shown in Figure 3. It was evident that the refractive index of eye fluids was correlated with the organoleptic quality. Quality score and refractive index are compared in Figure 4.

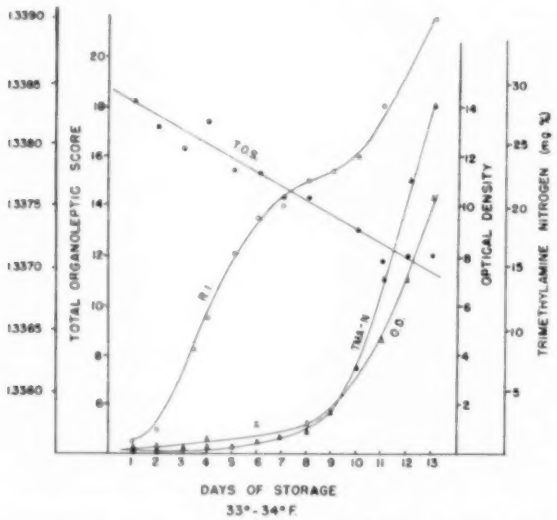

Figure 2. Tests for quality of haddock stored in ice at the labratory.

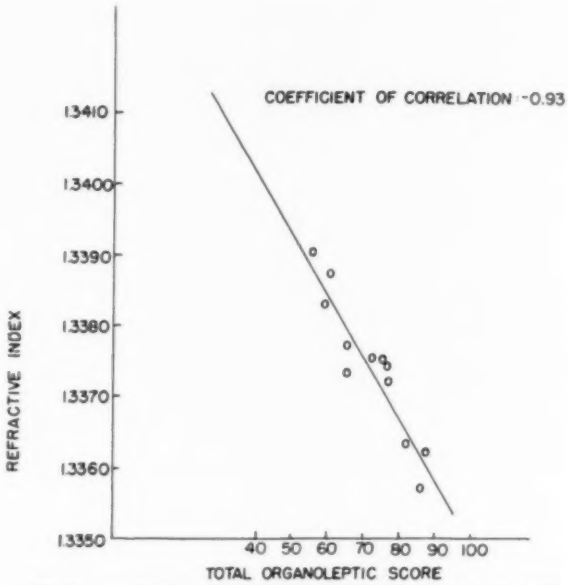

Figure 3. Regression curve of refractive index and total organoleptic score.

Figure 4. Quality score and refractive index compared.

Quality of Fresh Haddock	Quality Range	Refractive Index Range of Eye Fluids
Very Good to Excellent	80–100	1.3347 to 1.3366
Fair to Good	65–79	1.3367 to 1.3380
Poor	50–64	1.3381 to 1.3393
Not Marketable	49–Below	1.3394 or Higher

Although organoleptic tests were not made on fish held at 36–40° F. without ice, the refractive index of eye fluids of such fish increased progressively as storage continued. Moreover, these values increased at a faster rate than did those of fish held at 33–34° F. (Figure 5).

From tests made aboard the commercial dragger, a baseline refractive index of pre-rigor haddock eye fluids was determined. The values began to increase after rigor had passed and continued to increase thereafter as the fish were held (Figure 6). Tagged fish handled in the same manner as the regular catch of the trawler were tested for the refractive index of eye fluids and trimethylamine content of the flesh immediately upon being landed at the Boston Fish Pier. These values (Figure 7) indicate a considerable variation of haddock quality unloaded from a commercial otter trawler.

According to the results of bacterial counts made on the eye fluids of haddock in different stages of freshness, such fluids were essentially sterile until the fish reached the stage of incipient spoilage. Thereafter, these fluids became highly infected with bacteria and contained several million organisms per gram.

Since bacterial action did not increase the refractive index of eye fluids during normal periods of storage, it appeared that this change might be due to autolysis. Through paper chromatography, it was pos-

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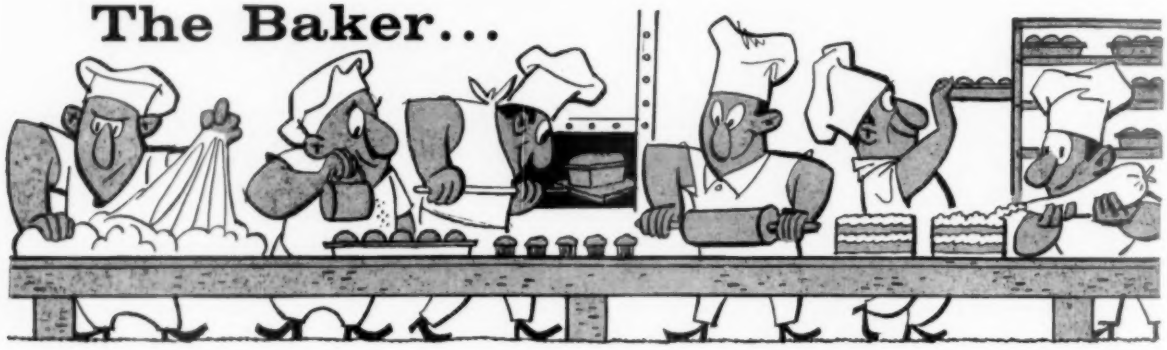

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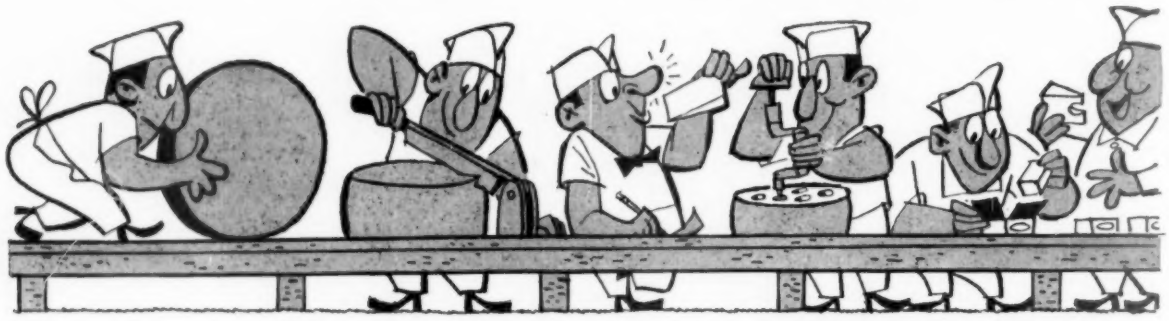

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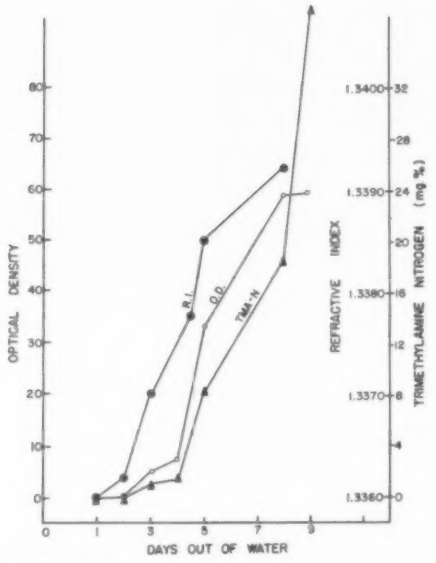

Figure 5. Tests for quality of haddock stored at 36-40° F.

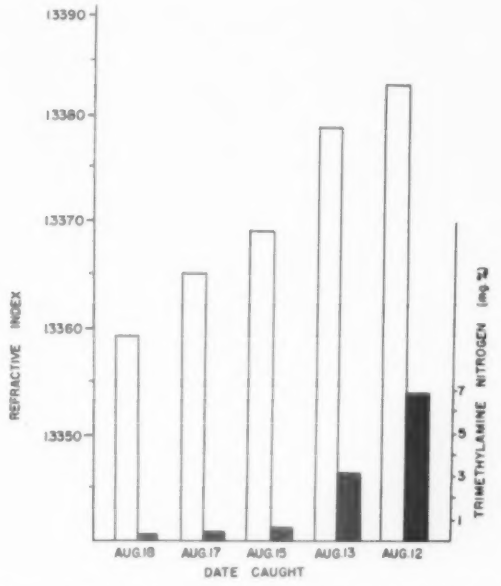

Figure 7. Test for quality of haddock made when landed, August 21, on specimens held for different periods aboard a commercial otter trawler.

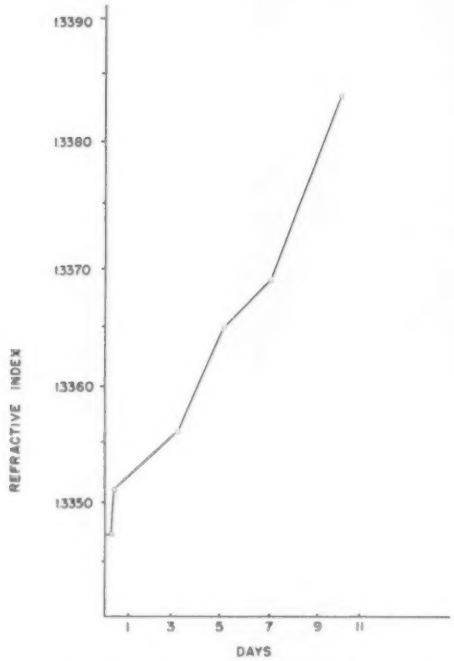

Figure 6. Refractive index of clarified eye fluids made at 0,3,6 and 8 hours after catching and throughout storage aboard a commercial otter trawler.

sible to show that a number of amino acids appeared in eye fluids as the fish were held and that their concentration increased with storage time.

SUMMARY AND CONCLUSIONS

A test based on the refractive index of the eye fluids has been developed as a criterion of the quality of haddock. The refractive index of haddock eye fluids was shown to be correlated with organoleptic scores made on cooked flesh from the same fish and with the time of storage at refrigerator temperatures above freezing.

Optical density tests on haddock eye fluids gave promising results but were not as suitable as were the refractive index measurements for quality indication.

Changes in the physical properties of haddock eye fluids during storage at refrigerator temperatures above freezing are probably due to enzyme action, since there was no evidence that bacterial composition is involved in such changes.

Acknowledgments

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Application of Differentially Coated Tin Plate for Food Containers•

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(Manuscript received May 31, 1958)

The development, manufacture, corrosion performance, and product applications of electrolytic tin plates have been adequately discussed in previous publications of our laboratories *(1, 4, 5, 10)*. This paper will report further progress in developing and applying to food products the differential type of electrolytic plate made over the past 5 years.

COMMERCIAL TIN PLATES

Commercially available tin plates are grouped into 2 major categories corresponding to their method of manufacture; namely, the hot dipping and the electrotinning processes. Table 1 lists the tin plates currently utilized by can manufacturers.

Electrolytic plates. The development of electrolytic plate, initiated in 1937, was based on No. 50 plate which, suitably enameled, was applied in containers or container parts as a tin conservation measure during World War II *(7)*. Before the end of the war, plain No. 75 plate was in general use for evaporated milk. No. 25 and No. 100 electrolytic plates achieved prominence in the postwar era, primarily for economic reasons. It was found that No. 25 plate could be used in product applications to which the more expensive No. 50 plate cans had previously been applied. It was likewise recognized *(10)* that No. 100 plate held economic potentialities as a replacement for hot dipped tin plate.

TABLE 1
Commercial tin plates

Description	Approximate average tin coating lbs./base box[1]
Hot Dipped	
Standard Cokes	1.35
Common Cokes	1.10
Electrolytic	
No. 100	1.00
No. 100-25 (Differential)	.625[2]
No. 75	.75
No. 50	.50
No. 25	.25

[1] Unit for commercial tin plate transactions. Area of 112 sheets 14 x 20 inches or 31,360 sq. in. A 1 lb./BB tin coating provides a thickness of approximately .000060 in. on each face of the sheet.

[2] No. 100 and No. 25 coatings for container inside and outside application respectively.

These electrolytic plates were alike in that all had the same tin coating weights on one side of the sheet as on the other. Otherwise stated, cans made from these electro-plates carried the same thickness of tin on the outside as on the inside of the container. When the commercial application of No. 100 electrolytic tin coating was being considered, the generally satisfactory outside can performance of No. 25 plate suggested that a "differentially" coated plate could be produced bearing a No. 100 tin coating for the inside and a No. 25 coating for the outside of the can. Such a plate became a commercial actuality in 1951 *(8)*.

The trend away from hot dipped plate to the electrolytic plates since 1942 has been quite marked and is illustrated graphically in Figure 1. In 1956, electrolytic tin plate accounted for about 80% of the total tin plate production.

This change to electrolytic coatings has also resulted in considerable savings in tin. Calculations based on total tin mill production, assuming for comparison the prewar hot dipped tin coating average of 1.31 lbs./BB, give the data shown in Figure 2. Much of the fluctuation shown is due to changes in tin prices for various years. The sharp increase in savings for 1951 is due both to the change from No. 50 to No. 25 and to the great increase in the price of tin during the Korean Incident. By 1954 the price of tin was fairly stable; therefore the larger savings for 1955 and 1956 are related to the shift from hot dipped to No. 100-25 plate. These savings are of special interest to the user since they were and still are reflected in the price of the cans.

TECHNICAL BACKGROUND OF DIFFERENTIALLY COATED PLATE

Early tests. Early trials with No. 100 electrolytic tin plate were disappointing. The plate was tested in plain (unenameled) cans for products for which plain hot dipped plate had been

• Presented at the Eighteenth Annual Meeting of the Institute of Food Technologists, Chicago, May 28, 1958.

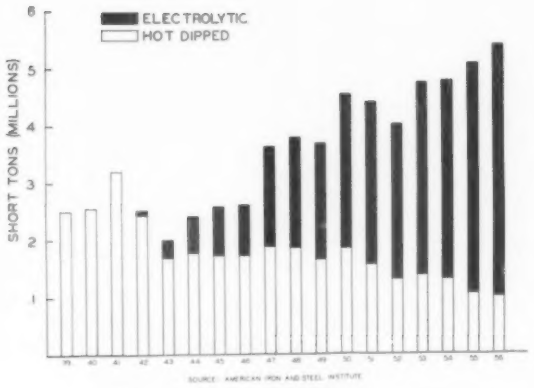


Figure 1. U. S. tin mill production.

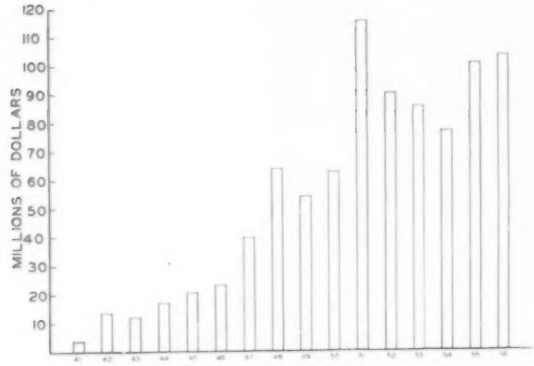


Figure 2. U. S. annual tin savings.

used successfully. Behavior was erratic and, while some of the No. 100 plate was equivalent or superior to hot dipped plate, most of the No. 100 plate showed considerably poorer corrosion resistance *(5, 10)*. This observation led to the supposition that surface characteristics of a subtle nature existed. Presumably those were carried through to the finished electrolytic plate in greater degree because the preparation procedures were not always as effective as the pickling and fluxing techniques unique to the hot dipping method.

In the intervening years "special property tests" have been developed which correlate well with the actual corrosion performance of plain tin plate containers *(11)*. These tests have proved valuable to the tin plate producers in arriving at a better understanding of means for controlling and improving the corrosion resistance of No. 100-25 plate.

Changes were made in equipment and manufacturing processes. Laboratory test packs of limited production runs were sufficiently encouraging to order commercial quantities of No. 100-25 plate from all producers in 1952. Operating experience was thus obtained to establish the conditions necessary for producing an acceptable product. The 1952 production of No. 100-25 plate was used primarily for tomato juice as previous tests had shown the plate would be satisfactory for this mildly corrosive product.

Line sampling tests. An extensive laboratory investigation was initiated at this time to provide a continuous evaluation of the corrosion resistance of commercial No. 100-25 plate. Arrangements were made with the producers to sample all of the No. 100-25 production in 1952 and the following years. These "line samplings" representing a cross section of production were subjected to the special property tests and were test packed with dried prunes, grapefruit juice, and tomato juice. Some samplings were also test packed with peaches, fruit cocktail, and pears. Cans were made from sheets from each sampling period in such a way that the sheet identity was retained to permit investigation of unusual performance by the producer. The average service life of the individual producer's material was calculated and expressed as a fraction of a control lot of plate which was used in a series of test packs.

Results with dried prunes showed that the general level of corrosion resistance of No. 100-25 plate did indeed rise in the first 2 years production. However, average shelf life is not the major technical problem, as illustrated by Figure 3, which gives the service life data of the 1952 line samplings packed with fruit cocktail. These data show that the 1952 production had an average shelf life almost equivalent to hot dipped plate then in use for the moderately corrosive fruits and that the problem is the occasional lot with lower corrosion resistance. This was only a limited sampling, and it is probable, of course, that an occasional lot having even lower minimum shelf life would have been encountered in a more extensive sampling.

Success of the producers in the years 1953, 1954, and 1955 in eliminating the occasional lot of poor corrosion resistance is well illustrated in Figure 4 which shows the test packs of each producer's line samplings with grapefruit juice stored at 100° F. Time to first failure is expressed as a fraction of a control lot to eliminate variations in corrosiveness of the grapefruit juice used as a test medium in each of 4 years. The general improvement in relative time to first failure is quite apparent.

Extending the use of differentially coated plate. Based on the 1952 production performance in special property tests and test packs, the use of No. 100-25 plate was extended in 1953 to the more corrosive products. For the dual reasons of caution in this major change in plate specifications and the limited availability of plate, canners were offered specified quantities of No. 100-25 cans on an expanding scale in the succeeding years. As an example, in 1953 No. 100-25 plate was offered for approximately 10% of the pack of the moderately corrosive light colored fruits such as peaches, pears, apricots, and fruit

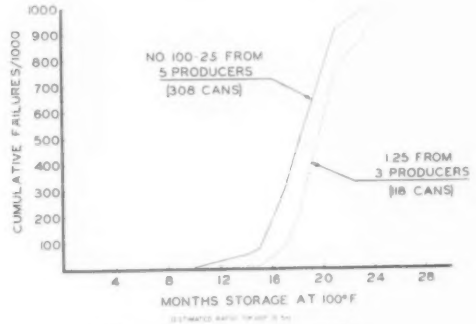


Figure 3. 1952 line sampling.

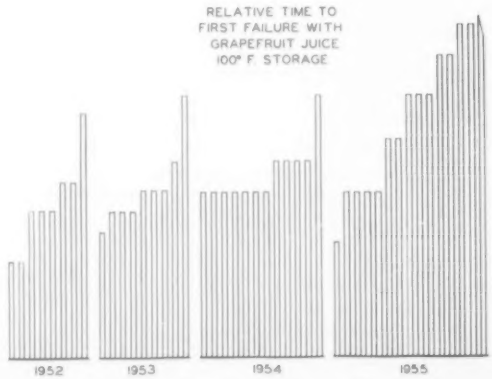


Figure 4. No. 100-25 line samplings.

cocktail. Successful experience and increasing material availability dictated increasing the quantities in 1954 to approximately 25% of the packs. In 1955 availability and confidence was such that No. 100-25 cans were offered for 100% of the packs of these foods.

Concurrently, additional laboratory test packs were made to confirm earlier results and to investigate the possibilities for foods not previously tested. In 1953, for example, our laboratories made 88 test packs, exclusive of the line samplings, with 60 different food products for a total of approximately 20,000 cans to investigate the use of No. 100-25 plate. Representative data collected from these test packs are shown in Figure 5.

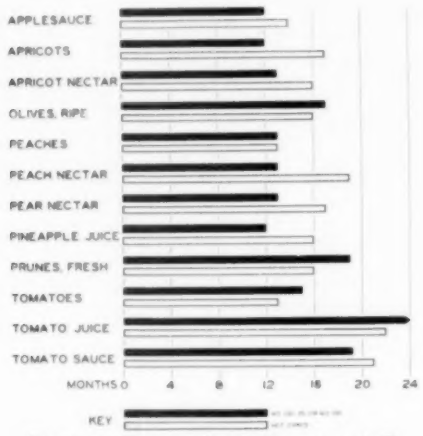


Figure 5. Time to first failure at 100° F.

Time to first failure at 100° F. for both No. 100-25 or No. 100 and the hot dipped plate control lot appear. For each product, the standard can construction was used, i.e. plain, combination,[b] or fully enameled. The data were obtained on several typical lots of commercial plate and therefore do not exclude the possibilities that lower and higher values might have occurred. In addition to these routine vacuum loss studies, samples were opened for detailed examination at intervals. Examination of these packs stored for 3 years at room temperature (average of 70° F.) showed no significant differences between the 2 types of plates as measured by vacuum loss, internal container appearance, or product condition.

The pattern of application of No. 100-25 plate to other foods was repeated in later years. This pattern involved determination of satisfactory shelf life by means of laboratory test packs followed by gradual introduction of the plate for commercial packs where laboratory data justified its use. Criteria used were: (a) assurance of adequate shelf life to permit marketing of a commercial pack with negligible risk of losses; (b) evidence of equivalent product quality when packed in No. 100-25 or hot dipped plate; and (c) satisfactory inside container appearance during normal shelf life requirement.

Present status of differentially coated plate. The success of this approach is best indicated by the list of food products for which No. 100-25 plate is now being supplied for essentially the entire pack:

1. Light colored, moderately corrosive fruits, their juices and nectars. These include citrus products, apples, apricots, peaches, pears, pineapple, and fruit cocktail.
2. Tomato products, including solid and standard pack, juice, pulp, puree, and sauce.

The 1956 pack of products in these two categories totaled over 230,000,000 cases *(9)*.

3. Most of the mildly corrosive vegetables such as carrots, sweet potatoes, pumpkin, and squash.
4. Many of the more corrosive foods packed in enameled cans; among these are ripe olives, fresh prunes and dark plums, and cranberry sauce.

In addition to the above, a number of products are in the transition stage from hot dipped to No. 100-25 electrolytic plate. Limited quantities of No. 100-25 are being used for cherries, berries, baby food, sauerkraut and many specialty items where there are variations in packers' formulas, such as pizza sauce, tomato juice with other vegetable juices, spaghetti, etc.

At this time, use of No. 100-25 electrolytic plate is not contemplated for 2 groups of food products. One comprises the highly corrosive foods which have short service life in hot dipped plate; examples are dried prune products *(2)* and rhubarb. The second group comprises vegetables which often show a strong tendency toward very rapid detinning in plain cans; examples are asparagus and spinach. The problem with these foods is one of product variation leading to unpredictable results. For example, Figure 6 shows time to first failure at 100° F. of 3 packs of California spinach made at different packing plants in one season in combination cans from the same lots of plate manufactured at one time. The pack from Plant C shows a striking reduction in shelf life with No. 100-25 plate. Also included in this Figure are analyses of dissolved tin in the product after 12 months' storage at 70° F. In the Plant C pack the No. 100-25 plate showed severe to almost complete detinning at this time; the hot dipped cans in all three packs were satisfactory in appearance.

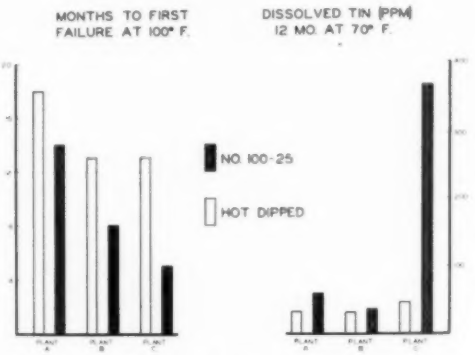


Figure 6. Influence of product variations—spinach.

COMMERCIAL CONSIDERATIONS

Internal corrosion. Successful use of billions of cans made of No. 100-25 plate over the past 5 years conclusively demonstrates that heavy electrolytic has been a satisfactory replacement for hot dipped plate. A few isolated early corrosion losses have been encountered; however, small, unexplained losses were always a part of the experience with hot dipped plate.

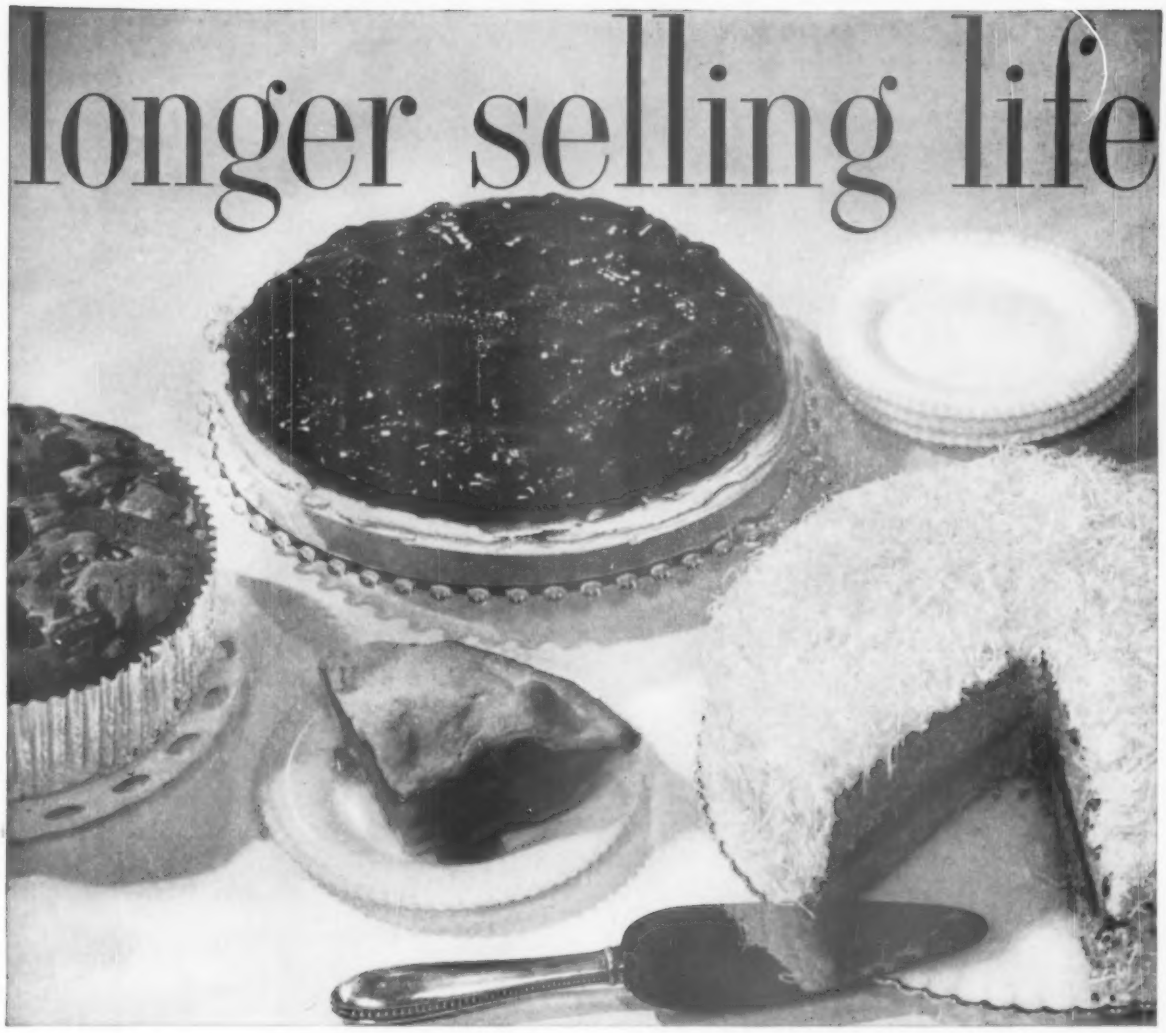
As previously mentioned, several of the major factors associated with the corrosion resistance of electrolytic plate have been identified and their control made possible by the special property tests. Investigations to identify the remaining factors are the subject of a continuing and extensive study.

Only recently has the size of the crystals in the tin coating been shown to have an important influence on corrosion resistance. Corrosion losses were encountered in the spring of 1957 in packs of grapefruit juice, orange juice, and similar citrus products which had been canned only 3 to 4 months previously.

(Continued on page 231 following program section)

[b] Cans with inside enameled electrolytic plate ends and plain (unenameled) No. 100-25 or hot dipped plate bodies.

longer selling life



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230A

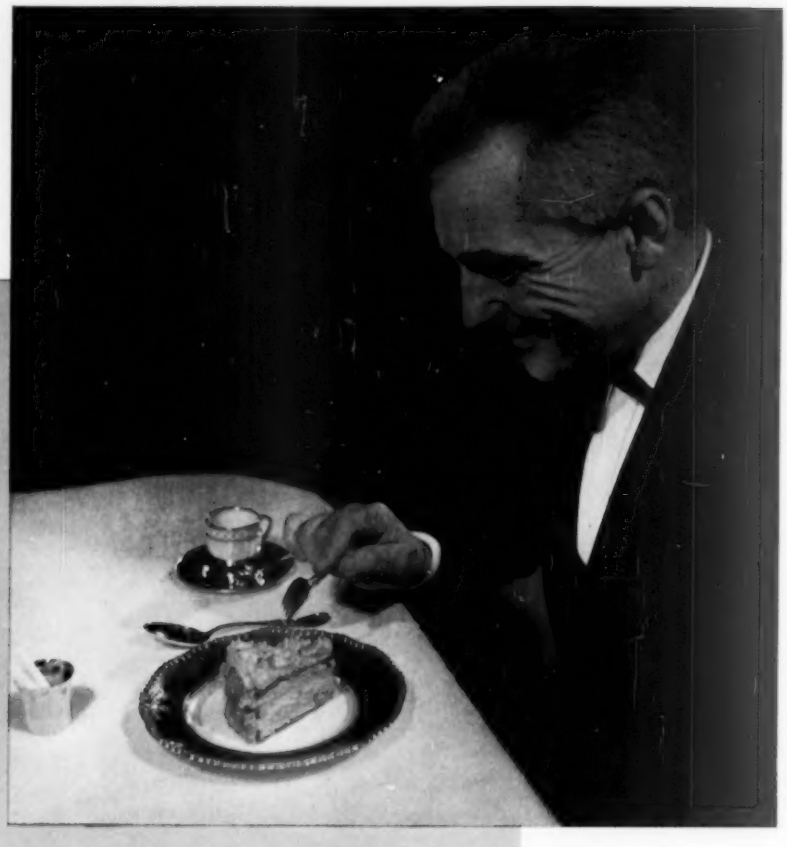

Table setting by
Tiffany, N.Y.

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LEADING CREATORS AND MANUFACTURERS IN THE WORLD OF FLAVOR

TECHNICAL PROGRAM AND ABSTRACTS

AND

GENERAL AND SOCIAL EVENTS

Nineteenth Annual Meeting

of the

Institute of Food Technologists

May 17 through May 21, 1959

The Bellevue-Stratford

Philadelphia, Pennsylvania

GENERAL AND SOCIAL EVENTS

FRIDAY, MAY 15, 1959

Executive Committee Meeting
9:00 A.M.—Clover Room, 1st floor

SATURDAY, MAY 16, 1959

Editorial Board Meeting
7:30 P.M.—Red Room, 1st floor

SUNDAY, MAY 17, 1959

National Council Meeting
10:00 A.M.—Burgundy Room, lobby floor

Registration and Tickets
12:30—5:30 P.M.—18th floor
7:00—9:30 P.M.—Clover Room, 1st floor

Exhibits—Official Opening
1:00—5:00 P.M.—18th floor

Ladies' Welcome Tea (husbands invited)
4:00—6:00 P.M.—Pink Room, 1st floor

Press Conference
4:00 P.M.—Blue Room, 1st floor

Complimentary Reception (all registrants)
8:00 P.M.—Ballroom, 1st floor

MONDAY, MAY 18, 1959

Section Officers' Breakfast
7:30 A.M.—Crystal Room, 1st floor

Registration and Tickets
8:00 A.M.—6:00 P.M.—18th floor

General Session
9:45 A.M.—Ballroom, 1st floor

Ladies' Historical Tour—Luncheon, Wanamaker store
10:00 A.M.—2:00 P.M.

Exhibits
11:00 A.M.—4:30 P.M.—18th floor

University of Massachusetts Luncheon
12:15 P.M.—Crystal Room, 1st floor

"Pennsylvania Night"—Dinner and Entertainment
7:00 P.M.—Ballroom, 1st floor.

TUESDAY, MAY 19, 1959

Massachusetts Institute of Technology Breakfast
7:30 A.M.—Crystal Room, 1st floor

University of California Breakfast
7:30 A.M.—Green Room, 1st floor

Oregon State Breakfast
7:30 A.M.—Pink Room, 1st floor

Canadian Breakfast
7:30 A.M.—Red Room, 1st floor

Registration and Tickets
9:00 A.M.—5:00 P.M., 18th floor

Ladies' Delaware Valley Tour (lunch at DuPont Country Club)—9:30 A.M.—5:00 P.M.

9:30 A.M.—5:00 P.M.

Exhibits
11:00 A.M.—4:30 P.M., 18th floor

University of Illinois Luncheon
12:15 P.M.—Pink room, 1st floor

University of Minnesota Luncheon
12:15 P.M.—Clover Room, First Floor

Babcock-Hart Award Address
1:45 P.M.—Ballroom, 1st floor

Awards Banquet and Entertainment
7:00 P.M.—Ballroom, 1st floor

WEDNESDAY, MAY 20, 1959

Phi Tau Sigma Breakfast
7:30 A.M.—Rose Room
John Bartram Hotel

University of Wisconsin Breakfast
7:30 A.M.—Green Room, 1st floor
Bellevue-Stratford Hotel

Ohio State Breakfast
7:30 A.M.—Pink Room, 1st floor
Bellevue-Stratford Hotel

Registration and Tickets
9:00 A.M.—5:00 P.M., 18th floor

Ladies' Events:
9:30 A.M.—Evening Bulletin Tour
10:30 A.M.—Art Museum Tour

Exhibits (final day)
11:00 A.M.—4:00 P.M., 18th floor

Installation Luncheon
12:00 noon—Burgundy Room, lobby floor

Appert Award Address
1:45 P.M.—Clover Room, 1st floor

Exhibitors' Prize Drawing
5:30 P.M.—Burgundy Room, lobby floor

THURSDAY, MAY 21, 1959

Registration
9:00 A.M.—12:30 P.M., 18th floor

Field Trips:
8:30 A.M.— 4:00 P.M.—Seabrook Farms (includes lunch)
9:00 A.M.—12:30 P.M.—American Stores Bakery
9:00 A.M.—12:30 P.M.—Crown Cork and Seal's Can factory.
9:00 A.M.—12:30 P.M.—U.S.D.A. Eastern Regional Laboratory
9:00 A.M.— 2:00 P.M.—Franklin Sugar Refinery (includes lunch)
9:30 A.M.— 1:00 P.M.—Campbell Soup Plant (includes lunch)

19th ANNUAL MEETING

General Information

Registration Fees:

Members	$10.00
Non-Members	15.00
Student Members	2.00
Student Non-Members	3.00
Exhibitors—6 for each exhibit	Free
Exhibitors—each additional	5.00
Wives or Husbands of members	Free

Tickets:

Tickets are required for all social events, ladies' trips, plant trips, banquet, special meals, etc. Ticket sales are limited to registered personnel presenting badges and ticket order forms, at least 8 hours prior to the event in order to guarantee accommodation. There will be no refunds on tickets.

Exhibits:

All exhibits are located on the 18th floor of the Bellevue-Stratford.

Admission to the Exhibit Area will be limited to registered personnel presenting badges.

Visiting hours for the exhibits are:

Sunday, May 17	1:00 to 5:00 P.M.
Monday, May 18	11:00 A.M. to 4:30 P.M.
Tuesday, May 19	11:00 A.M. to 4:30 P.M.
Wednesday, May 20	11:00 A.M. to 5:00 P.M.

All the newest developments in products, technical literature, instrumentation and processing equipment will be on display at the Commercial Exhibition on the 18th floor. Thorough inspection of these Exhibits will be rewarding to you—and be sure to spend time in getting acquainted with the Exhibitors.

Employment

Complete listings of food technology openings and available food technologists' qualifications may be consulted by qualified registrants at the Employment Headquarters, Rooms 107-108, 1st floor, Bellevue-Stratford, during the following hours:

Sunday—2:30--5:00 P.M.

Monday through Wednesday—9:00 A.M. to 4:30 P.M.

Interviews between prospective employers and applicants will be discreetly arranged by those in charge and treated confidentially to avoid any possible embarrassment.

LADIES ENTERTAINMENT PROGRAM

The Philadelphia Ladies Entertainment Committee has arranged a program which will show the Ladies as many aspects of our town and the Philadelphia area as possible, but still leave you enough time to enjoy leisure hours for individual plans.

The Bellevue-Stratford is located in the heart of Philadelphia and within walking distance of all our well-known department stores, the specialty shops, the theatres, the museums and the Academy of Fine Arts, which was the first Institute of its kind in America. You may want to visit some of these, and one of our hostesses will always be glad to assist you in any way.

We have planned the following exciting special events for your enjoyment:

Sunday: Afternoon tea from 4-6 P.M. in the Pink Room, Bellevue-Stratford, where your husband will also be welcome.

Monday: 10 A.M., tour of historical points in Philadelphia followed by luncheon at the Wanamaker store.

Tuesday: 9:30 A.M., a trip down lovely Delaware Valley for luncheon at the beautiful DuPont Country Club; this will be followed by a visit to the famous Longwood Gardens, located in Chester County, Pennsylvania—a *must* for flower enthusiasts.

Wednesday: 9:30 A.M., a tour through the Philadelphia Bulletin building, one of the most modern newspaper plants in America.

Also at 10:30 A.M. a tour is planned to The Art Museum on the Parkway, a magnificent building in a lovely setting, famous for its collections of paintings and its beautifully furnished period rooms, as well as the fashion wing, including Grace Kelly's wedding gown. Also, the Japanese tea house and scholar's study exhibits, recently featured in Life Magazine and the London News, are well worth seeing.

You may take both of these Wednesday tours or choose just one, with informal lunch at the Museum as you desire.

Thursday: The Field Trips Committee has arranged several plant tours. If you wish, you may join one of these.

There are, of course, additional events planned for the whole membership, which you will enjoy with the men. The "mixer" will be on Sunday evening; on Monday night, the Pennsylvania Dutch Dinner and Mummers Band, right in your hotel; and the Awards Banquet on Tuesday night.

The Gold Room will be our headquarters as a meeting point and information center. Coffee will be served there in the morning.

All buses will leave from the Broad Street entrance of the Bellevue-Stratford.

In order to assure you of good service, please purchase your tickets for all events well in advance; and we're sorry that we cannot accept cancellations less than 24 hours in advance.

NINETEENTH ANNUAL MEETING
FIELD TRIPS

Thursday, May 21, 1959

Registration:

A limited number of tickets (100) will be available for each of the plant tours. Distribution will be on a first-come, first-served basis. In order to insure your reservation for the tour of your choice, it is suggested that you procure tickets promptly.

General:

The Philadelphia area offers a large variety of facilities, engaged in widely divergent activities in the food industry. Six field trips have been arranged and are open to registrants of the Convention and their wives.

AMERICAN STORES BAKERY

PHILADELPHIA

The baking industry is well represented by one of the most modern and up-to-date bakeries in the country. Those who are interested in automatic operations will enjoy a tour through the American Stores Bakery in Metropolitan Philadelphia.

At the American Stores Bakery, it is planned that you will see their continuous bread baking operation, their cake and pastry operation and their control facilities. An opportunity will be provided at the end of the tour, as well as during the tour, to discuss the facilities with technical personnel.

Buses for this tour will leave the Bellevue-Stratford, Broad Street entrance at 9:00 A.M. and return at 12:30 P.M. Maximum Registration—100 people.

CAMPBELL SOUP COMPANY

CAMDEN, N. J.

Food preparation and canning can be observed by taking part in a tour through the facilities of the Campbell Soup Company, just across the Delaware River from Philadelphia in Camden, N.J.

It is planned that this tour will include the successive steps necessary to the production of Campbell soups and frozen foods. Preparation kitchens, automatic rapid-fill canning lines, the latest processing equipment, control and development laboratories, and other points of interest to the food technologist will be part of this field trip.

Tour will take approximately two hours and will be followed by lunch in the dining room of the Campbell Soup Executive offices. Buses will leave the Bellevue-Stratford, Broad Street entrance at 9:30 A.M. and return at 1:00 P.M. Maximum Registration—100 people.

CROWN CORK & SEAL COMPANY, INC.

CAN DIVISION, ERIE AVE. AT H ST.
PHILADELPHIA, PA.

The birthplace of the Spra-tainer, the original can for aerosol and pressurized food packing. With the current interest in the pressure packaging of foods, this is your opportunity to see the ultra-modern facilities for fabricating the only seamless low carbon steel can made in the United States. The bulk coil handling of metal and the unique bodymakers developed by Crown will be observed. Metal decorating of a fully fabricated container will be demonstrated including the first installation of its kind in the world today,—that of electrostatic spraying and induction heat curing of organic coatings and lithography on the Spra-tainer.

Buses for this tour will leave the Bellevue-Stratford, Broad Street entrance at 9:00 A.M. and return at 12:30 P.M. Maximum Registration—100 people.

EASTERN UTILIZATION RESEARCH LABORATORIES

U.S.D.A. (WYNDMOOR)

Government Research Activities on behalf of agriculture and the food industry, will be represented by a trip through the facilities of the U.S.D.A.'s Eastern Utilization Research Laboratories, 1959 winner of the Industrial Achievement Award.

It is planned that you will see the nationally famous laboratory facilities which have so ably served to help the food industry. Facilities which have been used to study flavor recovery systems and concentration procedures and which have aided in the development of dehydrated fruit juices, powdered whole milk and potato flakes will be included in the tour.

Buses for this tour will leave the Bellevue-Stratford, Broad Street entrance at 9:00 A.M. and return at 12:30 P.M. Maximum Registration—100 people.

FRANKLIN SUGAR REFINERY

PHILADELPHIA

Sugar represents a basic raw material for a large segment of the food industry. It is planned that you will see the complete operation in the production of sugar from the raw cane sugar through to the refined white sugar. Means of control used on production will also be included in the tour of Franklin Sugar Refinery.

Buses for this tour will leave the Bellevue-Stratford at 9:00 A.M. and return at 2:00 P.M. Maximum registration—100 people. Tour itself will take approximately three hours and lunch will be provided at the plant cafeteria.

SEABROOK FARMS

BRIDGETON, N. J.

Frozen food production and research at the Seabrook Farms plant in Bridgeton, New Jersey, will offer an opportunity for observing a modern food freezing operation. At Seabrook Farms, it is planned that you will see a complete modern frozen food operation from the cultivation and harvest of the raw materials to the processing, freezing, and packaging of the finished products.

The tour will include the Quality Control features necessary to so extensive an operation. In addition to direct food operations, the Seabrook Farms' facilities will include a tour and description of their unique waste disposal system.

Buses for this tour will leave the Bellevue-Stratford at 8:30 A.M. and return at 4:00 P.M. Maximum registration—100 people. Lunch will be provided at Seabrook Farms.

THE TECHNICAL PROGRAM

IN SUMMARY

Monday, May 18

9:45 A.M.—12:00 Noon
General Session, Ball Room, 1st floor

1:45 P.M. Technical Sessions:
Section A—*General Research*—Ball Room, 1st floor
Section B—*Cereal and Baked Products*—Burgundy Room, lobby floor
Section C—*Fruit Products*—Clover Room, 1st floor

Tuesday, May 19

9:00 A.M. Techincal Sessions:
Section D—*Radiation and Preservation*—Ball Room
Section E—*Heat Processing*—Burgundy Room
Section F—*Poultry*—Clover Room

1:45 P.M. *Babcock-Hart Award Address*—Ball Room

2:30 P.M. Technical Sessions:
Section G—*General Research*—Ball Room
Section H—*Meat*—Burgundy Room
Section I—*Food Engineering*—Clover Room

4:00 P.M. Section J—*Production Symposium*—Clover Room

Wednesday, May 20

9:00 A.M. Technical Sessions:
Section K—*Food Additives Symposium*—Ball Room
Section L—*Meat*—Burgundy Room

10:15 A.M. Section M—*Fish*—Burgundy Room

9:00 A.M. Section N—*Quality Control*—Clover Room

1:45 P.M. *Nicholas Appert Award Address*—Clover Room

2:30 P.M. Technical Sessions:
Section O—*Food Standards Symposium*—Ball Room
Section P—*Frozen Foods*—Burgundy Room
Section Q—*Packaging and Pressurized Containers*—Clover Room

IN DETAIL

MONDAY MORNING—MAY 18

General Session

Grand Ball Room

9:45— Opening Remarks
CARL D. PRATT, General Chairman

9:50— Welcome to Philadelphia
NORMAN KRAMER, Chairman, Philadelphia Section

9:55— General Announcements

10:00— Presidential Address
DR. AKSEL G. OLSEN

10:30— Fellowship and Scholarship Awards; IFT Industrial Achievement Award
HOWARD C. SPENCER

10:45— Keynote Address
MR. PAUL J. CUPP, American Stores Company, Philadelphia, Pennsylvania

MONDAY AFTERNOON—MAY 18

Section A—Ball Room

General Research

Chairman: H. H. MOTTERN
National Dairy Products Corp., Glenview, Illinois

1:45— 1. Chemistry of Non-Enzymic Browning—A Review of Recent Australian Work
THELMA M. REYNOLDS, Division of Food Preservation and Transport, Commonwealth Scientific and Industrial Research Organization, Homebush, New South Wales, Australia

2:15— 2. The Browning of Ascorbic Acid
SCOTT F. JACKSON, C. O. CHICHESTER, and M. A. JOSLYN, Department of Food Technology, University of California, Davis and Berkeley, California

2:30— 3. The Biosynthesis of Anthocyanins in Radishes
C. O. CHICHESTER and DUCK HIYON CHO, Department of Food Technology, University of California, Davis, California

2:45— 4. Control of Rutin Discoloration in Canned Asparagus
REES B. DAVIS, RICHARD B. GUYER, JOHN J. DALY, and HAROLD T. JOHNSON, Metal Division, Research and Development Department, Continental Can Company, 1350 W. 76th Street, Chicago 20, Illinois

3:00— 5. Factors Affecting the Development of *Bacillus coagulans* in Fresh Tomatoes and in Canned Tomato Juice
A. H. JONES, W. E. FERGUSON, and JEAN L. ROSS, Bacteriology Division, Science Service, Department of Agriculture, Government of Canada, Ottawa, Canada

3:15— 6. Lipolytic Activity of *Pseudomonas fluorescens* at Low Temperatures
L. E. ELLIOTT and JOHN A. ALFORD, U. S. Department of Agriculture, Agriculture Research Service, Eastern Utilization Research and Development Division, Agriculture Research Center, Beltsville, Maryland

3:30— 7. Carbonyls in Oxidizing Fat. III. The Distribution of Volatile and Non-Volatile Carbonyls
A. M. GADDIS, REX ELLIS, and GEORGE T. CURRIE, U. S. Department of Agriculture, Agriculture Research Service, Eastern Utilization Research and Development Division, Agriculture Research Center, Beltsville, Maryland

3:45— 8. The Role of Essential Oil of Carrot in Carrot Flavor and Off-Flavor
R. S. SHALLENBERGER, J. D. ATKIN, and J. C. MOYER, New York State Agricultural Experiment Station, Cornell University, Geneva, New York

4:00— 9. Bitterness in Celery
HUO-PING PAN, C. B. HALL, and R. A. DENNISON, Department of Food Technology and Nutrition, University of Florida, Gainesville, Florida

4:15— 10. Characteristics of Coffee Relating to Beverage Quality
ERNEST E. LOCKHART, Coffee Brewing Institute, Inc., 551 Fifth Avenue, New York 17, New York

4:30— 11. The Influence of High Temperature Holding upon the Components of Coffee Brew III. Sulfur-Containing Compounds
STANLEY SEGALL, Kwik-Kafe Coffee, Inc., Hatboro, Pennsylvania, and B. E. PROCTOR, Department of Food Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts

4:45— 12. On the Color of Coffee. III.
ANGELA C. LITTLE, C. O. CHICHESTER, and G. MACKINNEY, Food Technology Department, University of California, Davis and Berkeley, California

MONDAY AFTERNOON—MAY 18

Section B—Burgundy Room

Cereal and Baked Products

Chairman: W. F. GEDDES
Division of Agricultural Biochemistry, University of Minnesota, St. Paul, Minnesota

1:45— 13. Effect of Storage-Deteriorated Flour on the Fermentation Rate of Yeast
SAMUEL A. MATZ, Quartermaster Food and Container Institute for the Armed Forces, 1819 W. Pershing Road, Chicago 9, Illinois

2:00— 14. Pregelatinized Starches for the Food Processor
L. M. WALDT, Morningstar-Paisley, Inc., 630 W. 51st Street, New York 19, N. Y.

2:15— 15. The Effect of Several Silicones on Volume of Yellow Cakes
W. J. STADELMAN and GRACE BENNETT, Poultry Science Department, Purdue University, Lafayette, Indiana

2:30— 16. Some Factors Contributing to the Stability of Fat in Chilled Doughs
C. EDITH WEIR, AUDREY D. FREEMAN, JEAN D. PARSONS, and L. R. DUGAN, American Meat Institute Foundation, 939 East 57th Street, Chicago 37, Illinois

2:45— 17. Dietary Protein Requirements and Problems in Supplementation
JAMES B. ALLISON, Bureau of Biological Research, Rutgers University, New Brunswick, New Jersey

3:00— 18. Diagnostic Sanitation Analyses in Food and Drug Control
KENTON L. HARRIS, Division of Microbiology, U. S. Food and Drug Administration, Department of Health, Education, and Welfare, Washington 25, D. C.

3:15— 19. High Amylose Corn—Properties and Prospects
F. R. SENTI, Northern Regional Research Laboratory, U. S. Department of Agriculture, Peoria, Illinois

3:30— 20. Problems Involved in the Enrichment of Rice with Riboflavin
E. J. LEASE, Nutrition Department, Clemson College, Clemson, South Carolina

3:45— 21. The Use of Emulsifiers and Emulsified Oils to Reduce Cohesion in Canned White Rice
R. E. FERREL, U. S. Department of Agriculture, Agricultural Research Service, Western Regional Research Laboratory, 800 Buchanan Street, Albany 10, California

4:00— 22. The Effect of Heating on the Histological Structure of Rice Varieties
RUBY R. LITTLE and ELSIE H. DAWSON, U. S. Department of Agriculture, Agricultural Research Service, Human Nutrition Research Division, Washington 25, D. C.

4:15— 23. Recent Developments in Shortening
JOHN B. WOERFEL, Armour and Company, 401 N. Wabash Avenue, Chicago 11, Illinois

4:30— 24. Industry Variations from Conventional Bread Processing in Recent Years
REUBEN B. MECKEL, International Milling Company, Minneapolis, Minnesota

4:45— 25. Deinfestation of Wheat by Gamma Irradiation and the Effect of Dose Level on the Baking Properties of the Flour
E. J. JACKSON, JR., F. F. DAL PAN, and S. A. FRIEDMAN, Curtiss-Wright Corporation, Research Division, Quehanna, Pennsylvania

MONDAY AFTERNOON—MAY 18

Section C—Clover Room

Fruit Products

Chairman: C. H. HILLS
Eastern Regional Research Laboratory, Philadelphia, Pennsylvania

1:45— 26. Foam Drying
A. I. MORGAN and L. F. GINNETTE, U. S. Department of Agriculture, Western Regional Research Laboratory, Albany, California

2:00— 27. A Microscopic Study of the Structural Changes of Peaches and Pears During Softening
CHUNG H. SON and W. A. MACLINN, Rutgers University, New Brunswick, New Jersey

2:15— 28. Sweetness and Acidity Adjustment in Canned Bartlett Pears
MARION SIMONE, L. L. CLAYPOOL, SHERMAN J. LEONARD, and B. S. LUH, Department of Food Technology, University of California, Davis, California

2:30— 29. Sugar Distribution in Plant Tissues Cooked in Syrup
CLARENCE STERLING, Department of Food Technology, University of California, Davis, California

2:45— 30. Anthocyanase Activity and Its Possible Relation to Scald in Sour Cherries
A. C. WAGENKNECHT, D. M. SCHEINER, and J. VAN BUREN, New York State Agricultural Experiment Station, Geneva, New York

3:00— 31. The Effect of Borates and Other Inhibitors on Enzymatic Browning in Apple Tissue
K. BEDROSIAN, Whirlpool Corp. Research Labs., St. Joseph, Michigan, and A. I. NELSON and M. P. STEINBERG, Department of Food Technology, University of Illinois, Urbana, Illinois

3:15— 32. The Recovery of Methyl Anthranilate in Concord Grape Essence
NORMAN F. ROGER, U. S. Department of Agriculture, Eastern Regional Research Laboratory, Philadelphia, Pa.

3:30— 33. The Constituents of the Crystalline Deposits on Dried Fruit
M. W. MILLER and C. O. CHICHESTER, Department of Food Technology, University of California, Davis, California

3:45— 34. Studies on the Storage Deterioration of California Dates
V. P. MAIER and FRANK H. SCHILLER, U. S. Department of Agriculture, Fruit and Vegetable Chemistry Laboratory, Pasadena, California

4:00— 35. Influence of Variety, Maturity, and Storage on the Quality of Canned Apple Sauce
ROBERT C. WILEY and VERNER TOLDBY, University of Maryland, College Park, Maryland

4:15— 36. Consistency and Syneresis Studies with Apple Sauce
VERNER TOLDBY and ROBERT C. WILEY, University of Maryland, College Park, Maryland

4:30— 37. A Rapid Method for the Production of a Sparkling Apple Wine
F. E. ATKINSON, J. F. BOWEN, and D. R. MacGREGOR, Canada Department of Agriculture, Fruit Processing Laboratory, Summerland, B. C., Canada

4:40— 38. Studies of Blending of Apple Varieties for Fermented Apple Wine
J. F. BOWEN, D. R. MacGREGOR, and F. E. ATKINSON, Canada Department of Agriculture, Fruit Processing Laboratory, Summerland, B. C., Canada

TUESDAY MORNING—MAY 19

Section D—Ball Room

Radiation and Preservation

Chairman: FERDINAND P. MEHRLICH
Quartermaster Food and Container Institute for the Armed Forces Chicago 9, Illinois

9:00— 39. Potential Economic Impact of Food Irradiation
R. HAL MASON and SAMUEL I. TAIMUTY, Stanford Research Institute, Menlo Park, California

9:15— 40. Tooling-Up for Low-Dose Irradiation Processing of Fresh Foods
WARREN W. EUKEL, Applied Radiation Corp., Walnut Creek, California, and WOLFGANG HUBER, Consultant, San Francisco, California

9:30— 41. Dose Distribution in Irradiated Samples
D. E. YOUNG, General Mills, Inc., 2010 East Hennepin Avenue, Minneapolis 13, Minnesota

9:45— 42. Biochemical Alteration of Milk Proteins by Gamma and Ultraviolet Irradiation
H. F. KRAYBILL, M. S. READ, R. S. HARDING, and T. E. FRIEDEMANN, U. S. Army Medical Research and Nutrition Laboratory, Denver 8, Colorado

10:00— **43.** Radiation Sterilization of Food. I. Procedures for the Evaluation of the Radiation Resistance of Spores of *Clostridium botulinum* in Food Products

C. F. SCHMIDT and W. K. NANK, Metal Research and Development Department, Continental Can Co., Chicago, Illinois

10:15— **44.** Effects of Electron Beam Irradiation on the Microbial Content of Spices and Teas and Their Volatile Constituents

PETER A. LERKE and LIONEL FARBER, Fisheries Research Laboratory, The George Williams Hooper Foundation, University of California, San Francisco 22, California

10:25— **45.** Production and Prevention of Irradiated Odor in Beef

P. A. HEDIN, G. W. KURTZ, and R. B. KOCH, Quartermaster Food and Container Institute for the Armed Forces, Quartermaster Research and Engineering Command, U. S. Army, Chicago 9, Illinois

10:35— **46.** Effects of Pre-Irradiation Heat Inactivation of Enzymes on Acceptability of Beef and Pork

A. M. PEARSON, L. J. BRATZLER, and R. N. COSTILOW, Food Technology Program, Michigan State University, East Lansing, Michigan

10:45— **47.** Color Changes in Pigment-Free Residues from Gamma-Irradiated Green Beans, Broccoli, Sweet Potatoes and Carrots

F. J. FRANCIS, G. E. LIVINGSTON, R. FRANCESCHINI, T. WISHNETSKY, University of Massachusetts, Amherst, Massachusetts

10:55— **48.** Effects of Ionizing Radiation on Gelatin and the Role of Various Radioprotective Agents

A. BOLAFFI, J. F. MEZZINO, J. R. LOWRY, and R. R. BALDWIN, General Foods Research Center, Tarrytown, New York

11:05— **49.** Preservation of Pacific Coast Shellfish and Smoked Fish with Ionizing Radiations

R. O. SINNHUBER, JOYCE FERGUSON, and T. C. YU, Oregon State College, Corvallis, Oregon

11:15— **50.** Antioxidants in Irradiated Cooked Pork

B. G. TARLADGIS, MARGARET T. YOUNATHAN, and BETTY M. WATTS, Florida State University, Tallahassee, Florida

11:25— **51.** Influence of Fat Content on the Palatability of Irradiated Beef

R. L. HENDRICKSON, D. R. BELLIS, J. J. GUENTHER, G. V. ODELL, and L. E. WALTERS, Animal Husbandry Dept., Oklahoma State University, Stillwater, Oklahoma

11:35— **52.** Maple Sirup. XIV. Ultraviolet Irradiation Effects on the Growth of Bacteria and Yeasts

I. S. SCHNEIDER, H. A. FRANK, and C. O. WILLITS, U. S. Department of Agriculture, Eastern Regional Research Laboratory, Philadelphia, Pennsylvania

11:45— **53.** Radiation Preservation of Milk. IX. Studies on Irradiation-Induced Gelation of Concentrated Milk

B. E. PROCTOR, S. A. GOLDBLITH, J. E. HOFF, and J. G. SUNYACK, Department of Food Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts

11:55— **54.** Treatment of Onions and Potatoes with Gamma Rays: Effects of Delay between Harvest and Irradiation

W. R. MULLINS, C. E. HENDEL, and H. K. BURR, U. S. Department of Agriculture, Western Regional Research Laboratory, Albany, California

TUESDAY MORNING—MAY 19

Section E—Burgundy Room

Heat Processing

Chairman: C. OLIN BALL
Rutgers University, New Brunswick, New Jersey

9:00— **55.** Product-Induced Stratification of Covering Syrups

R. C. NICHOLAS, I. J. PFLUG, and T. R. MULVANEY, Food Technology Program, Michigan State University, East Lansing, Mirhigan

9:15— **56.** Low Temperature Handling of Sterilized Foods. I. Design of Equipment and Preliminary Investigations

ARNOLD I. EPSTEIN and C. OLIN BALL, Food Science Department, Rutgers University, New Brunswick, New Jersey

9:30— **57.** Frigi-Canning

EDWARD F. KOHMAN, Consultant, King's Highway East, Merchantville 9, New Jersey

9:45— **58.** Thermal Resistance of Microorganisms to Dry Heat: Design of Apparatus, Operational Problems, and Preliminary Results

I. J. PFLUG, Food Technology Program, Michigan State University, East Lansing, Michigan

10:00— **59.** Problems in the Preparation and Handling of Hot Vended Canned Food

G. T. PETERSON, J. F. FOX, and L. E. MARTIN, Metal Division Research and Development, Continental Can Company, 1350 West 76th Street, Chicago 20, Illinois

10:15— **60.** Influence of Blanching Conditions on Sloughing, Splitting, and Firmness of Canned Snap Beans

J. P. VAN BUREN, J. C. MOYER, D. E. WILSON, and W. B. ROBINSON, New York State Agricultural Experiment Station, Cornell University, Geneva, New York

SYMPOSIUM ON BLANCHING

10:30— **61.** Food Blanching—Its Role in Food Irradiation

JOHN T. R. NICKERSON, Department of Food Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts

10:45— **62.** Blanching in Freezing Preservation

FRANK A. LEE, New York State Agricultural Experiment Station, Cornell University, Geneva, New York

11:00— **63.** The Interaction Between Blanching and Drying Rates of Peas

J. C. MOYER, H. R. PALLESEN, and R. S. SHALLENBERGER, Department of Food Science and Technology, New York State Agricultural Experiment Station, Geneva, New York

11:15— Discussion

TUESDAY MORNING—MAY 19

Section F—Clover Room

Poultry

Chairman: W. J. STADELMAN
Purdue University, Lafayette, Indiana

9:00— **64.** Antibiotics in Poultry Meat Preservation: *In Vitro* Development of Bacterial Resistance to Chlortetracycline

REESE H. VAUGHN, HENRY NG, GEORGE F. STEWART, CHARLES W. NAGEL, and KENNETH L. SIMPSON, Department of Food Technology, University of California, Davis, and the U. S. Department of Agriculture, Agricultural Marketing Service, Davis, California

9:15— 65. Microorganisms Responsible for Spoilage of Commercially Processed Chilled Poultry
CHARLES W. NAGEL, KENNETH L. SIMPSON, HENRY NG, REESE H. VAUGHN, and GEORGE F. STEWART, U. S. Department of Agriculture, Agricultural Marketing Service, Davis, and Department of Food Technology, University of California, Davis, California

9:30— 66. Relationships among pH, Water Contents, and Tenderness in Turkey Meat
J. W. DODGE and W. J. STADELMAN, Poultry Science Department, Purdue University, Lafayette, Indiana

9:45— 67. Distribution of Methionine and Cystine in Poultry Meat
J. L. FRY and W. J. STADELMAN, Poultry Science Department, Purdue University, Lafayette, Indiana

10:00— 68. Resazurin Reduction Tests for Shelf Life Estimations of Poultry Meat
F. E. WELLS, Poultry Science Department, Purdue University, Lafayette, Indiana

10:15— 69. Tenderness at Various Muscle Depths Associated with Poultry Processing Techniques
R. G. WISE and W. J. STADELMAN, Poultry Science Department, Purdue University, Lafayette, Indiana

10:30— 70. Doneness of Frozen, Defrosted Turkey Halves Roasted to Several End Point Temperatures
GRAYCE E. GOERTZ, KATHERINE COOLEY, MARTINE C. FERGUSON, and DOROTHY L. HARRISON, Department of Foods and Nutrition, Kansas State College, Manhattan, Kansas

10:45— 71. Development of the Poultry Inspection Act
FRANK G. WOLLNEY, Institute of American Poultry Industries, 59 East Madison Street, Chicago 2, Illinois

TUESDAY AFTERNOON—MAY 19

The Babcock-Hart Award Address

DR. SAMUEL LEPKOVSKY, *Awardee*

1:45 P.M.—Ballroom

TUESDAY AFTERNOON—MAY 19

Section G—Ball Room

General Research

Chairman: H. H. MOTTERN
National Dairy Products Corp., Glenview, Illinois

2:30— 72. Oxidations in Model Systems Related to Dehydrated Foods
S. J. BISHOV, A. S. HENICK, and ROBERT B. KOCH, Quartermaster Food and Container Institute for the Armed Forces, 1819 West Pershing Road, Chicago 9, Illinois

2:45— 73. Factors Influencing the Absorption of Potato Flour
MILES J. WILLARD, JR., and WILLIAM J. ENGLAR, JR., Food Products Division, Rogers Brothers Seed Co., S. Chamerlain Avenue, Idaho Falls, Idaho

3:00— 74. Polyphenolic Content and Enzymatic Activity of Two Varieties of Potatoes as Affected by Maturity and Storage
NELL I. MONDY, BARBARA P. KLEIN, and LANELL IRVIN, Department of Food and Nutrition, Cornell University, Ithaca, New York

3:15— 75. Control of Exudation in Prepeeled French-Fry Potatoes with Antibiotics
F. J. FRANCIS, B. L. AMLA, and A. KIRATSOUS, Department of Food Technology, University of Massachusetts, Amherst, Massachusetts

3:30— 76. Browning of Potato Chips. I. Effect of Total Solids on Color Intensity
V. RACENIS, W. A. MACLINN, and R. E. MORSE, Food Science Department, Rutgers University, New Brunswick, New Jersey

3:45— 77. Extending the Shelf Life of Creamed Cottage Cheese by Means of Sorbic Acid
G. PERRY and R. L. LAWRENCE, Best Foods Division of Corn Products Co., Bayonne, New Jersey

4:00— 78. The Variable Taste Perception of Sodium Benzoate
D. R. PERYAM, Quartermaster Food and Container Institute for the Armed Forces, Chicago 9, Illinois

4:15— 79. Change in Volatile Constituents During the Sherry Baking Process
LEONARD R. MATTICK and WILLARD B. ROBINSON, Department of Food Science and Technology, New York State Agricultural Experiment Station, Cornell University, Geneva, New York

4:30— 80. A Continuous Process for Dehydrating Honey
VICTOR A. TURKOT and RODERICK K. ESKEW, Eastern Utilization Research and Development Division, 600 E. Mermaid Lane, Philadelphia 18, Pennsylvania

TUESDAY AFTERNOON—MAY 19

Section H—Burgundy Room

Meat

Chairman: B. A. WRIGHT
Armour and Company, Chicago, Illinois

2:30— 81. Effect of Metallic Iron on the Spoilage of Canned Pork Luncheon Meat
LLOYD L. KEMPE and JOHN T. GRAIKOSKI, the University of Michigan, Ann Arbor, Michigan

2:45— 82. Curing of Ham: A Study of Sodium Chloride Accumulation. II. Combined Effects of Time, Solution Concentration, and the Solution Volume
H. E. WISTREICH, R. E. MORSE, and L. J. KENYON, Food Science Department, Rutgers University, New Brunswick, New Jersey

3:00— 83. Patterns of Redness Loss and Regeneration in Prepackaged Beef
R. W. DEAN and C. OLIN BALL, Food Science Department, Rutgers University, New Brunswick, New Jersey

3:15— 84. Some Factors Influencing Color Uniformity and Stability in Cured Hams
E. H. RONGEY, O. J. KAHLENBERG, and H. D. NAUMANN, Food Processing Laboratories, Missouri Agricultural Experiment Station, Columbia, Missouri

3:30— 85. Improving the Stability and Acceptability of Precooked Freeze-Dried Ham

A. F. ANGLEMEIER, DAVID C. CRAWFORD, and H. W. SCHULTZ, Department of Food and Dairy Technology, Oregon State College, Corvallis, Oregon

3:45— 86. Variations in the Quality of Raw and Cooked Pork
OLIVE M. BATCHER and ELSIE H. DAWSON, U. S. Department of Agriculture, Agricultural Research Service, Institute of Home Economics, Human Nutrition Research Division, Washington 25, D. C.

4:00— 87. Effects of pH and Ionic Strength on the Extractability of Bovine Muscles
ROBERT J. GIBBS and ALBERT J. FRYAR, U. S. Department of Agriculture, Agricultural Research Service, Eastern Utilization Research and Development Division, Agricultural Research Center, Beltsville, Maryland

4:15— 88. Factors Affecting the Water Retention of Beef. II. Variations in some pH Determinants Among Eight Muscles
C. E. SWIFT, M. D. BERMAN, and C. LOCKETT, U. S. Department of Agriculture, Agricultural Research Service, Eastern Utilization Research and Development Division, Agricultural Research Center, Beltsville, Maryland

4:30— 89. Efficacy of Oxytetracycline for Aging Beef
R. B. SLEETH and H. D. NAUMANN, Food Processing Laboratories, Missouri Agricultural Experiment Station, Columbia, Missouri

4:45— 90. Meat Flavor Studies. I. The Fractionation of the Non-Volatile Flavor of Beef
GEORGE W. KURTZ, YUMIO YONEZAWA, S. W. LESLIE, and EDWARD L. FONG, Quartermaster Food and Container Institute for the Armed Forces, 1819 West Pershing Road, Chicago 9, Illinois

5:00— 91. Meat Flavor Studies. II. Identification of the Ninhydrin Positive Compounds from Beef Flavor Concentrates
GEORGE W. KURTZ, YUMIO YONEZAWA, S. W. LESLIE, and PAUL A. HEDIN, Quartermaster Food and Container Institute for the Armed Forces, 1819 West Pershing Road, Chicago 9, Illinois

5:15— 92. Methods for Evaluating Freeze-Dried Beef
L. J. N. COLE and W. R. SMITHIES, Defence Research Medical Laboratories, Toronto 12, Ontario, Canada

TUESDAY AFTERNOON—MAY 19

Section I—Clover Room

Food Engineering

Chairman: I. J. PFLUG
Michigan State University, East Lansing, Michigan

2:30— 93. Design of Freeze-Drying Equipment for the Dehydration of Foodstuffs
W. R. SMITHIES and T. S. BLAKLEY, Defence Research Medical Laboratories, Toronto 12, Ontario, Canada

2:45— 94. Fouling of Evaporator Tubes by Tomato
A. I. MORGAN and T. WASSERMAN, U. S. Department of Agriculture, Western Regional Research Laboratory, 800 Buchanan Street, Albany 10, California

3:00— 95. Longitudinal Temperature Distribution in a Scraped Surface Heat Exchanger
JOHN L. BLAISDELL and JOHN W. ZAHRADNIK, Department of Agricultural Engineering, University of Massachusetts, Amherst, Massachusetts

3:15— 96. Heat Transfer in Hot Fat Cooking
HORACE L. SMITH, Horace L. Smith, Jr., Inc., 2416 West Cary Street, Richmond 20, Virginia

3:30— 97. Lye-Pressure Steam Peeling of Potatoes and Other Products
HAROLD W. ADAMS and FRANK D. HICKEY, Food Machinery and Chemical Corp., 333 W. Julian Street, San Jose, California, and MILES WILLARD, Rogers Seed Co., Idaho Falls, Idaho

3:45— 98. Food Engineering for Atomic Submarines
CHARLES M. SCHOMAN, JR., Naval Supply Research and Development Facility, Bayonne, New Jersey

TUESDAY AFTERNOON—MAY 19

Section J—Clover Room

Production Symposium

Chairman: JOHN H. NAIR
Consultant, Summit, New Jersey

4:00— 99. How the Food Technologist Helps the Production Men
E. C. RITCHELL, Green Giant Co., LeSuer, Minnesota, M. S. BURNS, California Vegetable Concentrates, Huntington Park, California, E. L. MORIN, Seabrook Farms, Seabrook, New Jersey, RICHARD RATH, Rath Packing Co., Waterloo, Iowa, JOHN H. NAIR, Consultant, Summit, New Jersey

5:00— Discussion

WEDNESDAY MORNING—MAY 20

Section K—Ball Room

Food Additives Symposium

Chairman: J. F. MAHONEY
Merck and Co., Inc., Rahway, New Jersey

9:00— Introductory Remarks

9:10—100. The Food Additive Amendment of 1958
ARTHUR A. CHECCHI, Food and Drug Administration, Washington 25, D. C.

9:25—101. The Problem of the Package
RICHARD D. O'NEILL, Syracuse University Research Corporation, 1075 Comstock Avenue, Syracuse 10, New York

9:40—102. Flavoring Agents as Food Additives
RICHARD L. HALL, McCormick & Co., Inc., 414 Light Street, Baltimore 2, Maryland

9:55—103. Food Additives: Food Protection Committee Activities
PAUL E. JOHNSON, National Academy of Sciences—National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

10:10—104. Some Pressing Problems under the Food Additives Amendment of 1958
BERNARD L. OSER, Food and Drug Research Laboratories, Inc., Maurice Avenue at 59th Street, Maspeth 78, New York

10:30— Questions and Answers

WEDNESDAY MORNING—MAY 20

Section L—Burgundy Room

Meat

Chairman: B. A. WRIGHT
Armour and Company, Chicago, Illinois

9:00—105. Effect of pH on the Water-Holding Capacity of Meat as Determined by Three Different

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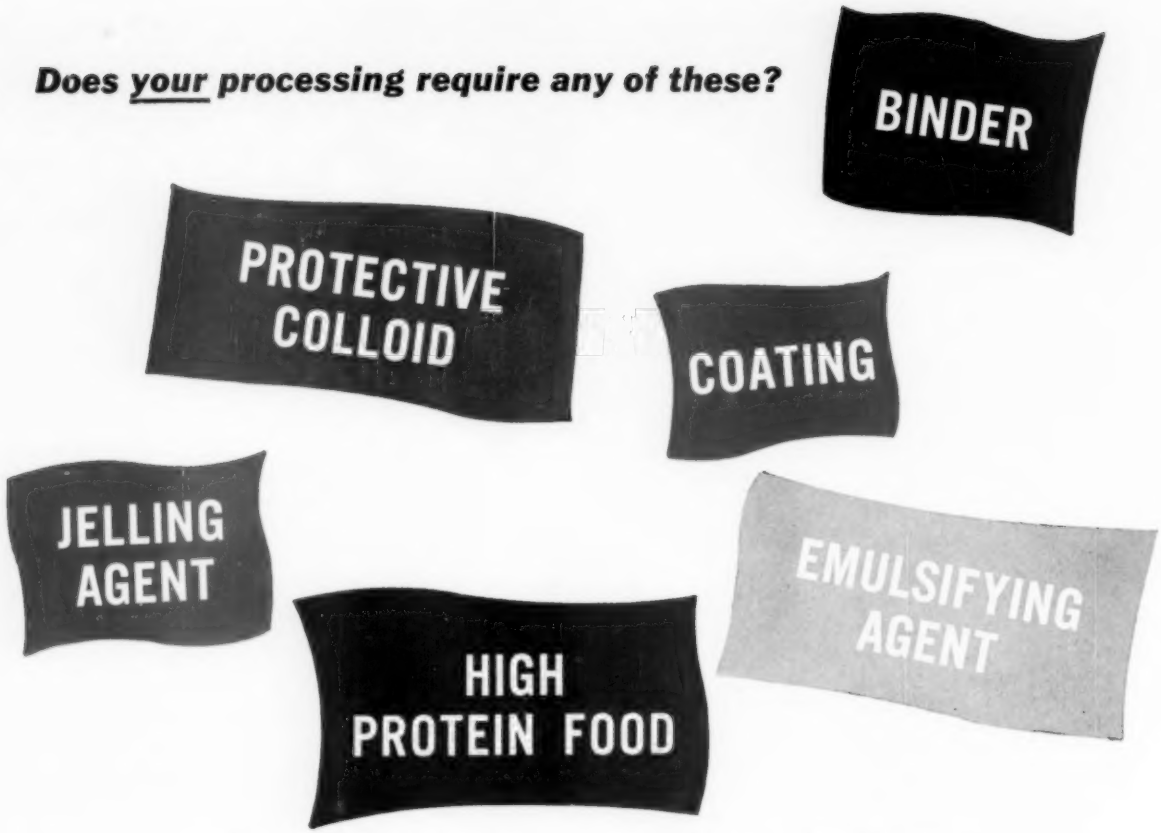

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Methods for Water-Holding Determination
EUGEN WIERBICKI, M. G. TIEDE, and R. C. BURRELL, The Rath Packing Company, Research and Development Department, Waterloo, Iowa

9:15—106. Heat Resistance and Growth Characteristics of Microorganisms Isolated from Non-Sterile Canned Hams
W. L. BROWN, C. A. VINTON, and C. E. GROSS, John Morrell and Company, Ottumwa, Iowa

9:30—107. The Effect of Sugar on the Flavor and Color of Smoked Hams
FRANKLIN MILLS, C. EDITH WEIR, and G. D. WILSON, American Meat Institute Foundation, 939 E. 57th Street, Chicago 37, Illinois

WEDNESDAY MORNING—MAY 20

Section M—Burgundy Room

Fish

Chairman: C. F. EVERS
Ac'cent International, Skokie, Illinois

10:15—108. Factors Affecting the Efficiency of Antibiotic Dips for Fresh Fish Fillets
C. M. BLACKWOOD, J. LISTON, and J. A. STERN, College of Fisheries, University of Washington, Seattle 5, Washington

10:30—109. Variations in the Chemical Composition of Halibut Flesh
CLAUDE E. THURSTON and PATRICIA P. McMASTER, U. S. Department of the Interior, Bureau of Commercial Fisheries, Fish and Wildlife Service, 2725 Montlake Boulevard, Seattle 2, Washington

10:45—110. Thermal and Non-Thermal Degradation of Chlortetracycline in Fish and Some Shellfish
E. F. KLINE, A. ABBEY, M. C. FIRMAN, and P. F. HOPPER, Agricultural Division, American Cyanamid Company, Princeton, New Jersey

11:00—111. Penetration of Tetracycline Antibiotics into Tuna and Sole Flesh and Their Stability during Steaming and Retorting
PETER A. LERKE and LIONEL FARBER, Fish Research Laboratory, Hooper Foundation, University of California, San Francisco 22, California

WEDNESDAY MORNING—MAY 20

Section N—Clover Room

Quality Control

Chairman: A. P. SIDWELL
U. S. Department of Agriculture, Marketing Research Division Biological Sciences Branch, Beltsville, Maryland

9:00—112. Quality Control of Potato Flake Production
MILES J. WILLARD, JR., and WILLIAM J. ENGLAR, JR., Rogers Brothers Seed Co., Idaho Falls, Idaho

9:15—113. Derivation of a New Formula for Computing Raw Tomato Juice Color from Objective Color Measurement
JOHN N. YEATMAN, ARTHUR P. SIDWELL, and KARL H. NORRIS, U. S. Department of Agriculture, Agriculture Marketing Service, Biological Sciences Branch, Plant Industry Station, Beltsville, Maryland

9:30—114. Procedure for Developing Schedules of Payment for Raw Materials on a Quality Basis
AMIHUD KRAMER and B. A. TWIGG, Department of Horticulture, University of Maryland, College Park, Maryland

9:45—115. Slurry Flow Measurement as a Method to Determine the Quality of Certain Raw, Blanched, and Canned Vegetables
ROBERT C. WILEY, University of Maryland, College Park, Maryland

10:00—116. A New Method for Screening Flavor Panel Members and Its Application to a Two Sample Difference Test
BARBARA A. HALL, MAE GOODWIN TARVER, JOAN G. McDONALD, Continental Can Co., Inc., 1350 W. 76th Street, Chicago 20, Illinois

10:15—117. A Study of a Spectrophotometric Method for the Flavor Evaluation of Insecticide Treated Vegetables
DANIEL ROSENFIELD, ARNOLD I. EPSTEIN, ELIZABETH F. STIER, and WALTER A. MACLINN, Food Science Department, Rutgers University, New Brunswick, New Jersey

10:30—118. Factors Affecting the Consistency of Catsup
BERNARD A. TWIGG and A. KRAMER, Department of Horticulture, University of Maryland, College Park, Maryland

WEDNESDAY AFTERNOON—MAY 20

The Nicholas Appert Award Address

DR. BERTON S. CLARK, *Awardee*

1:45 P.M.—Clover Room

WEDNESDAY AFTERNOON—MAY 20

Section O—Ball Room

Food Standards Symposium

Definitions and Standards of Identity, the Pro's and Con's

Moderator: FRANK L. GUNDERSON, *Consultant*
1000 Dupont Circle Building, Washington, D. C.

2:30—119. Introduction and Background
FRANK L. GUNDERSON, Consultant

2:50—120. What Informed Consumers Expect from Foods Standards
MARY B. WOOD, Cornell University

3:10—121. Views of a Professor of Food Technology
KENNETH G. WECKEL, University of Wisconsin, Madison, Wisconsin

3:30—122. An Industry View of Federal Definitions and Standards of Identity for Foods
F. N. PETERS, JR., The Quaker Oats Company, Chicago, Illinois

3:50— Discussion, Questions and Answers

WEDNESDAY AFTERNOON—MAY 20

Section P—Burgundy Room

Frozen Foods

Chairman: J. G. WOODROOF
Georgia Experiment Station, Experiment, Georgia

2:30—123. Ascorbic Acid and Carotene Content of Frozen Broccoli as Affected by Various Factors
M. E. MARTIN, J. F. SWEENEY, G. L. GILPIN, and V. CHAPMAN, U. S. Department of Agriculture, Agricultural Research Service, Human Nutrition Research Division, Washington, D. C.

2:45—124. Composition and Quality Evaluation of Boysenberries for Frozen Pies

D. E. ROHRER and B. S. LUH, Department of Food Technology, University of California, Davis, California

3:00—125. Effect of Temperature on Storage Stability of Frozen Cakes

JAMES W. PENCE and MARJORIE HEID, U. S. Department of Agriculture, Agricultural Research Service, Western Regional Research Laboratory, 800 Buchanan Street, Albany 10, California

3:15—126. Time-Temperature Tolerance of Frozen Foods. Quality Changes in Frozen Spinach Stored in Retail Packages

W. C. DIETRICH, MILDRED M. BOGGS, MARVEL-DARE NUTTING, and N. E. WEINSTEIN, U. S. Department of Agriculture, Agricultural Research Service, Western Utilization Research and Development Division, 800 Buchanan Street, Albany 10, California

3:30—127. Studies on the Freezing of Starch and Starch Derivative Systems

JAMES J. ALBRECHT, A. I. NELSON, and M. P. STEINBERG, Food Technology Department, University of Illinois, Urbana, Illinois

3:45—128. Comparative Storage Stability of Selected Precooked Frozen Poultry Products

GRACE BENNETT, W. J. STADELMAN, and JEAN NESSET, Purdue University, Lafayette, Indiana

4:00—129. Freezing and Thawing Rates of Poultry Meat

J. DAVID MITCHELL and W. J. STADELMAN, Purdue University, Lafayette, Indiana

4:15—130. Preventing Darkening of Meat near the Bone of Frozen Poultry

J. G. WOODROOF and CORDELIA ELLIS, Georgia Experiment Station, Experiment, Georgia

4:30—131. Time-Temperature Tolerance of Frozen Foods: Ready-to-Cook, Cut-Up Chicken

A. A. KLOSE, M. F. POOL, A. A. CAMPBELL, and H. L. HANSON, U. S. Department of Agriculture, Agricultural Research Service, Western Regional Research Laboratory, Albany, California

4:45—132. Experiments on Food Preservation with a New Ice Containing Glycol Diformate and Sorbic Acid

SOCRATES A. KALOYEREAS, R. M. CROWN, CHARLES S. McCLESKY, and CLAYTON BRUNSON, Louisiana State University, Baton Rouge, Louisiana

WEDNESDAY AFTERNOON—MAY 20

Section Q—Clover Room

Packaging and Pressurized Containers

Chairman: EUGENE J. KANE

Thomas J. Lipton, Inc., Hoboken, New Jersey

2:30—133. Prolonging the Storage Life of Fresh Beef by Use of a Film Impregnated with Antibiotic

JOHN C. AYRES, Food Processing Laboratory, Department of Dairy and Food Industry, Iowa State College, Ames, Iowa

2:45—134. Microbiological Aspects of Pressure Packaged Foods. II. The Effect of Various Gases and Packing Procedures

G. L. HAYS, J. D. BURROUGHS, R. C. WARNER, and E. WHEATON, Research and Technical Department, American Can Company, Maywood, Illinois and Barrington, Illinois

3:00—135. Pressure Dispensed Liquid Coffee Concentrate

E. D. GIGGARD, Continental Can Co., Inc., 1350 West 76th Street, Chicago 20, Illinois

3:15—136. Flexible Packaging Materials and Inert Gas Increase Shelf Life of Food Products

GERALD B. GROSS, Milprint, Inc., 420 Lexington Avenue, New York 17, New York

3:30—137. Aluminum Packaging—Today's Trends and Techniques

ROBERT B. NOTTINGHAM and JOHN M. FULTZ, Reynolds Metal Company, Research and Development Laboratory, 10th and Byrd Streets, Richmond, Virginia

3:45—138. The Stabilizing of Tin-Plate Surfaces

R. A. NEISH and J. G. DONELSON, Applied Research Laboratory, U. S. Steel Corporation, Monroeville, Pennsylvania

4:00—139. Freon C-318 and Nitrous Oxide Mixtures as Food Aerosol Propellents

F. W. BLODGETT, E. I. Dupont de Nemours, Inc., Wilmington, Delaware, and R. C. WEBSTER, Air Reduction Co., Inc., Madison, Wisconsin

ABSTRACTS

1
CHEMISTRY OF NON-ENZYMIC BROWNING—A REVIEW OF RECENT AUSTRALIAN WORK

THELMA M. REYNOLDS
Division of Food Preservation and Transport, Commonwealth Scientific and Industrial Research Organization
Homebush, New South Wales, Australia

Fruits have been used as the basis of these investigations of the chemistry of non-enzymic browning in foods. The work discussed has been done by E. F. L. J. Anet, A. S. F. Ash, D. L. Ingles, and the author. The identity of the sugars, organic acids, and free amino acids in apricots and peaches was first established. Blanched, freeze-dried purées of these fruits were used to study the chemical changes occurring in storage. The stored material contained compounds which appeared to be amino acid-deoxyfructoses and sugar mono-esters of the organic acids. These compounds were synthesized and the structure of the esters was studied. The compounds formed in the fruit were identified by comparison. Quantitative determinations were made of many of the amino acids, organic acids, sugars, and reaction products.

Some of the reactions which may occur in foodstuffs have been studied in model systems. Qualitative and kinetic studies were made of the effect of bisulphite, malate, and phosphate on the reacton of glycine and glucose. The rate of reaction of different amino acids with glucose was studied. Crystalline addition products were prepared from aldoses and potassium and amine bisulphites and the hydrolytic reactions of these compounds were studied. It was found that fructose-glycine, the Amadori rearrangement product from glucose and glycine, reacted with glucose to give difructose-glycine. The reactions of the breakdown products from difructose-glycine were studied.

2
THE BROWNING OF ASCORBIC ACID

SCOTT F. JACKSON, C. O. CHICHESTER, and M. A. JOSLYN
Food Technology Department, University of California
Davis and Berkeley, California

As a part of an investigation of the browning of citrus juices, the browning of ascorbic acid was studied in buffer solutions aerated with oxygen. Earlier studies under similar conditions except for the inclusion of C^{14} glycine showed that little or no CO_2 was evolved from the glycine and that at least in the early stages of browning amino acids were not involved in the darkening of ascorbic acid solutions. In the present investigation no amino compound was used but the buffer compounds were labeled with C^{14}. It was shown that only 2 to 4% of the evolved CO_2 was traceable to the buffer. Thus, it may be concluded that not only is the Strecker degradation inoperative in ascorbic acid browning but that the VitC. directly gives rise to the CO_2 evolved.

Additional experiments on the catalysis of the reaction showed that light had a negative catalytic effect as did heavy metals.

3
THE BIOSYNTHESIS OF ANTHOCYANINS IN RADISHES

C. O. CHICHESTER and DUCK HIYON CHO
Food Technology Department, University of California, Davis, California

Uniformly labeled fructose and carboxyl labeled acetate were incorporated into isolated radish tubers to observe the synthesis of anthocyanin from these compounds. After 24 hours the anthocyanin was extracted with absolute methanol and isolated by paper chromatography. In all cases the anthocyanin was labeled from the radioactive compounds. The anthocyanin was systematically degraded to yield glucose, and anthocyanidin and the latter further degraded to yield phloroglucinol and protocatechuric acid by alkaline fusion. These compounds were isolated by paper chromatography and their activity determined. Activity was generally distributed throughout the structural parts of the anthocyanidin when either compound was labeled. More activity was found in the phloroglucinol when carboxyl labeled acetate was used than when fructose was needed. When fructose was the active compound a greater portion of the activity was found in the protocatechuric acid.

The results strongly suggest that the synthesis of cyanidin diglucoside by the radish is similar to the synthesis of quercetin suggested by Underhill and Neish in that ring A is synthesized from acetate by head to tail linkages and ring B from sugars through the shikimic acid pathway.

4
CONTROL OF RUTIN DISCOLORATION IN CANNED ASPARAGUS

REES B. DAVIS, RICHARD B. GUYER, JOHN J. DALY, and HAROLD T. JOHNSON
Metal Division Research and Development Department
Continental Can Company
1350 W. 76th Street, Chicago 20, Illinois

Oxidative rutin discoloration of canned asparagus, which occurs after opening the container, has been a recurring problem for many years. Several workers have previously established rutin as the cause of discoloration. This paper reviews various basic factors which control development of the ferric-rutinate complex causing discoloration. In addition, the work presented was designed to show the effect of these basic factors and to determine practical canning procedures for avoiding discoloration.

5
FACTORS AFFECTING THE DEVELOPMENT OF *BACILLUS COAGULANS* IN FRESH TOMATOES AND IN CANNED TOMATO JUICE

A. H. JONES, W. E. FERGUSON, and JEAN L. ROSS
Bacteriology Division, Science Service, Department of Agriculture, Government of Canada
Ottawa, Canada

One of the problems encountered in studies on *Bacillus coagulans*, the organism associated with "flat-sour" tomato juice, has been the difficulty experienced in growing the test organism in the usual canned juice. Studies with both the vegetative and spore stages of this organism have indicated that tomato juice generally is not a favorable medium. Growth will develop only under specific conditions and particularly when the pH of the juice is altered to the less acid state. In view of the importance of pH in the development of *B. coagulans*, studies have been conducted to determine conditions conducive to the development of this organism in tomato juice.

Results of studies have indicated that tomatoes held in the field after harvesting, a common practice used to develop a better color, or held at the plant before processing, invariably become less acid and pH readings as high as 5.00 have been recorded on individual tomatoes. The change in pH will depend to a considerable extent on the temperature of holding, the higher the temperature, within a range of 20° C. to 45° C., the greater the change.

During the past season it was found that tomatoes sprayed with a suspension of *B. coagulans* at various stages of the holding period showed a marked increase in the rate of growth of the test organism coinciding with the change in pH. This increased rate of growth occurred when the pH reached 4.30 and continued until the appearance of heavy mold contamination. At this time both increases and decreases in the rate of growth were observed. A preliminary study of molds isolated from the tomatoes showed that some molds produced an antibiotic which inhibited some strains of *B. coagulans*. These findings suggest that holding tomatoes after harvesting, particularly at relatively high temperatures, may be a predominant factor in the development of "flat-sour" spoilage.

6
LIPOLYTIC ACTIVITY OF *PSEUDOMONAS FLUORESCENS* AT LOW TEMPERATURES

L. E. ELLIOTT and JOHN A. ALFORD
United States Department of Agriculture, Agricultural Research Service, Eastern Utilization Research and Development Division, Agricultural Research Center,
Beltsville, Maryland

Effects of bacterial lipase on fats containing only the higher molecular weight fatty acids have not been thoroughly investigated, particularly with respect to the effect of temperature on their activity. Studies were made to determine what medium and what surface-to-volume ratio would give the maximum

lipolytic activity of *Pseudomonas fluorescens* on lard. The relationship of total count to production of lipase at temperatures ranging from 0° to 35° C. also was determined.

It was found that 1% peptone broth buffered at pH 7.0 gave maximum lipase production. Good yields of lipase were obtained in shallow layers of medium, whereas lipase production per cell was considerably less in both aerated cultures and in cultures grown in deep layers of medium.

Lipase production was very slight at 30° C. although good cell yields were obtained. At 20° C. easily detectable levels of lipase were observed in 2–3 days. Although the rate of cell growth and of lipase activity were decreased by lowering the temperature from 20° C. to 5° C. it was found that the amount of enzyme produced per cell at 5° C. was at least as great as at 20° C. This was apparent only when the activity was measured at 20° rather than at the lower temperature at which it was produced. The optimum temperature for the lipase was near 40° C. and was not affected by the temperature at which the cells were grown.

7

CARBONYLS IN OXIDIZING FAT. III. THE DISTRIBUTION OF VOLATILE AND NON-VOLATILE CARBONYLS

A. M. GADDIS, REX ELLIS, and GEORGE T. CURRIE
United States Department of Agriculture, Agricultural Research Service, Eastern Utilization Research and Development Division, Agricultural Research Center, Beltsville, Maryland

This paper describes comparisons of methods of isolating and estimating carbonyl compounds in oxidized pork fat. A major portion of the carbonyl compounds determinable in oxidized fat does not volatilize, and apparently contributes little directly to rancid flavors. The purpose of this work was to determine the nature of the non-volatile carbonyls and to select procedures best suited to study of relationships of carbonyls with "off" flavors.

The Girard T. reagent was used to isolate the total carbonyls. This method separated a high proportion of the total carbonyls indicated to be present by the technique of Henick *et al.* Carbonyls were also isolated by steam distillation, vacuum distillation, bisulfite complex, and the Pool and Klose method. Approximately 50% or more of the total carbonyls in the fat were composed of dicarbonyls. Most of this fraction was non-volatile, and it apparently was not in a bound form, as it was also readily isolated by the mild Pool and Klose procedure. About 90% of the monocarbonyls separated by the Girard method were steam volatile, although only 10%–15% of this fraction could be isolated from the fat by steam distillation, vacuum distillation, and the Pool and Klose method. Apparently the Girard method breaks down bound forms and precursors of the monocarbonyls.

8

THE ROLE OF ESSENTIAL OIL OF CARROT IN CARROT FLAVOR AND OFF-FLAVOR

R. S. SHALLENBERGER, J. D. ATKIN, and J. C. MOYER
New York State Agricultural Experiment Station
Cornell University
Geneva, New York

Sondheimer and others have demonstrated that the nonvolatile portion of bitter carrot flavor is due to compound "A" or 3-methyl-6-methoxy-8-hydroxy-3,4-dihydroisocoumarin. We have directed our effort toward the volatile component of bitter carrot flavor. The steam distillates of bitter carrots are turbid and strong-tasting, whereas the steam distillates of nonbitter carrots are clear and bland tasting. By methods of steam distillation, solvent extraction and fractional distillation *in vacuo*, 1.44 g. bitter carrot flavor compound "B" were obtained from 500 pounds of bitter carrots. Compound "B" appears to be a sesequiterpene alcohol, emperical formula $C_{14}H_{22}O_2$. Compound "B" is harsh, hot, and bitter and possesses typical carrot flavor. It occurs in excess in bitter carrots and can be significantly detected in carrots by a flavor panel at concentrations of about 0.001%. Additional constants are given.

9

BITTERNESS IN CELERY

HUO-PING PAN, C. B. HALL, AND R. A. DENNISON
Department of Food Technology and Nutrition
University of Florida
Gainesville, Florida

A bitter principle was isolated from celery. The method of isolation and the properties of the bitter principle will be discussed.

10

CHARACTERISTICS OF COFFEE RELATING TO BEVERAGE QUALITY

ERNEST E. LOCKHART
Coffee Brewing Institute, Inc., 551 Fifth Avenue
New York 17, New York

Beverage acceptance has been correlated with weight of grounds to water volume ratios, with extraction of soluble materials from the grounds and with dilution of the water soluble materials. Highly acceptable beverage is made, if ground to water ratios range from 1.85 to 2.52 gallons per pound: if extraction from the grounds is held between 18 and 22 percent and if solids extracted are maintained between 1.15 and 1.35 per cent.

Several characteristics of coffee, such as bulk density, grind, degree of roast and total extractable material have been studied in relation to these quality criteria. The results of this study will be presented.

11

THE INFLUENCE OF HIGH TEMPERATURE HOLDING UPON THE COMPONENTS OF COFFEE BREW III. SULFUR-CONTAINING COMPOUNDS

S. SEGALL
Kwik-Kafé Coffee, Inc., Hatboro, Penna.
and
B. E. PROCTOR
Massachusetts Institute of Technology
Cambridge, Massachusetts

Studies were made on the content of hydrogen sulfide, sulfur dioxide, and sulfhydryl compounds in coffee brew. The behavior of these compounds in coffee brew under conditions of heating normally used in commercial coffee brewing was noted. Implications of these findings in terms of concurrent organoleptic evaluations are discussed.

12

ON THE COLOR OF COFFEE. III.

ANGELA C. LITTLE, C. O. CHICHESTER, and G. MACKINNEY
Food Technology Department, University of California
Davis and Berkeley 4 ,California

Improvements were made on the modified Jabez-Burns Roaster previously described (*Food Technol.*, 12, 505–7, 1958), to allow for closer temperature control and rapid cooling of the roasted beans. The present report extends the investigation of factors affecting color of coffee by determining the effect of the initial moisture content of beans of a given variety on the color of the finished roast. Varying conditions of time and temperature of roast to yield a product of a constant color (as measured by its tristimulus Y value) are also explored. The objective of this phase of the investigation is to establish time-temperature equivalents and to determine the effect of roasting conditions on the flavor of a finished roast of a given color.

13

EFFECTS OF STORAGE DETERIORATED FLOUR ON THE FERMENTATION RATE OF YEAST

SAMUEL A. MATZ
Quartermaster Food and Container Institute for the Armed Forces, 1819 West - rshing Road
Chicago 9, Illin ..

The decline in baking quality of flour which frequently occurs upon extended storage has usually been attributed to the effect on physical dough properties of some product of deterioration even though this effect has been diffic to demonstrate in model systems. An alternate explanation, which appears not to have been adequately investigated, is that the products of deterioration (e.g., free fatty acids) affect the rate of gas evolution during dough fermentation. A series of experiments is described in which the fermentation rates of yeast acting on sugar solutions in the presence of flours of different storage histories are compared. It is shown that the rate of gas evolution is significantly affected by the storage treatment of the flour.

14

PREGELATINIZED STARCHES FOR THE FOOD PROCESSOR

L. M. WALDT
Morningstar-Paisley, Inc., 630 W. 51st Street
New York 19, New York

The increasing consumer demand for "convenience foods" is making it necessary for the food processor to evaluate the use of precooked starches in many different types of prepared food products. In consideration of this rising market, an over-all discussion of pregelatinized starches—from drum-drying through application—is offered. Ways and means of evaluating such starches are given and formulations of typical food items, such as pie fillings, icing mixes, fountain-ades, toppings, etc. containing pregelatinized starches as a basic ingredient, are shown.

The economic advantages in the use of precooked starches are discussed in specific cases. Problems which arise in the processing and preparation of foods containing pregelatinized starches are outlined.

15

THE EFFECT OF SEVERAL SILICONES ON VOLUME OF YELLOW CAKES

W. J. STADELMAN and GRACE BENNETT
Poultry Science Department, Purdue University
Lafayette, Indiana

The widespread applications of silicones has led to speculation concerning traces of such materials as contaminants in the components being responsible for cake failures. A study was completed in which 7 silicones were incorporated into the batters of yellow cakes at levels of 0.1, 1.0 and 10 p.p.m. For all cakes, a complete commercial yellow cake mix was used. Three cakes of each of the 22 treatment formulations were baked in each of two separate laboratories using different personnel.

No cakes baked were of such poor volume so as to be classed as failures. The inclusion of 0.1 or 1.0 p.p.m. of the various silicones used had no appreciable effect on volume of yellow cakes. Inclusion of 10 p.p.m. of several of the silicones resulted in a decrease in cake volume by as much as 20%.

16

SOME FACTORS CONTRIBUTING TO THE STABILITY OF FAT IN CHILLED DOUGHS

C. EDITH WEIR, AUDREY D. FREEMAN,
JEAN D. PARSONS, and L. R. DUGAN
American Meat Institute Foundation, 939 East 57th Street
Chicago 37, Illinois

The stability of the fat portion of raw and baked pastry dough was studied during 36 weeks of storage at 20°, 0° and −10° F. Nine fat preparations were studied. They included prime steam lard, lard stabilized with butylated hydroxyanisole, butylated hydroxytoluene, propyl gallate, and citric acid, both singly and combined, and a hydrogenated vegetable shortening. Fat stabilities were measured by Schaal oven storage, ASTM bomb measurement, peroxide and free fatty acid content. The stability of the fat system was unaffected by baking prior to low temperature storage and by the storage temperatures studied. There was a variation in fat stability during storage, but no marked over-all loss. The stability tended to decrease at 12 weeks and to increase at 20 weeks storage. The ASTM bomb and Schaal oven stability data correlated well (0.85) when samples of diverse stability were tested.

17

DIETARY PROTEIN REQUIREMENTS AND PROBLEMS IN SUPPLEMENTATION

JAMES B. ALLISON
Bureau of Biological Research, Rutgers University
New Brunswick, New Jersey

Dietary protein requirement is a function of the physiological state of the individual, the caloric intake, and the pattern of amino acids provided by the diet. The efficiency of utilization of the dietary protein for tissue protein synthesis is a function of this pattern. The pattern presented to the body depends upon the amino acid composition of the dietary protein, digestion and absorption. The amount of synthesis is also correlated with the nitrogen intake while the rate is affected by the caloric intake. The pattern of amino acids, and nitrogen and caloric requirements for the depleted adult are similar to those for the growing individual. Improvement of the protein in the diet, therefore, must take into consideration all of these factors affecting nitrogen retention in the body. Supplementation of a diet with protein sources or with amino acids, for example, would have little value if the nitrogen intake or caloric intakes were inadequate or out of balance. If the Biological Value of the mixture of proteins in the diet is below 60 some change should be made to improve the pattern of amino acids. Normal growth or repletion cannot be obtained simply by increasing nitrogen intake of a mixture of proteins with a low biological value. The key to good nutrition is a balance between the essential components of the diet and the role of the Food Technologist in helping to provide this balance is becoming more and more important.

18

DIAGNOSTIC SANITATION ANALYSES IN FOOD AND DRUG CONTROL

KENTON L. HARRIS
Division of Microbiology, U. S. Food and Drug Administration
Department of Health, Education, and Welfare
Washington 25, D. C.

"Sanitation Analysis" is a term now applied to examinations of foods for the presence of insect or rodent filth and for findings which may be used as an index of insanitary handling. Insect fragments, when identified with the insect species, have excellent diagnostic use. Government regulatory agencies may use them as evidence of insanitation at times pinpointing the offense. Control laboratories may use specific fragment identification for raw materials and storage control or on the finished product as a final check on processing sanitation. Industry groups are now training in this work. Some literature source materials and examples are presented.

19

HIGH AMYLOSE CORN—PROPERTIES AND PROSPECTS

F. R. SENTI
U. S. Department of Agriculture
Agriculture Research Service
Northern Regional Research Laboratory
Peoria Illinois

Corn having starch with more than the normal content of about 27 percent of amylose is of interest as a source of a new type of starch. The progress and present status of the development of high-amylose corn and studies on high-amylose starch will be reviewed. Thus far analyses on breeding samples of corn have indicated genetic increases of amylose up to 82 percent in the starch in the course of a cooperative program between plant breeders and chemists: corn having starch of 50 to 60 percent amylose content could be available in quantity by 1960. The properties of high-amylose starches will be discussed in the light of the properties and molecular structure of amylose and amylopectin, the linear and branched molecular components, respectively, of starch. The relationship of structure and properties to potential industrial uses will be considered in such fields as coatings and films.

20

PROBLEMS INVOLVED IN THE ENRICHMENT OF RICE WITH RIBOFLAVIN

E. J. LEASE
Nutrition Department
Clemson College
Clemson, South Carolina

The Federal standard for enriched rice specifies that it must contain the same amounts of riboflavin, thiamine, niacin, and iron as enriched flour or corn meal. The riboflavin requirement for enriched rice has been stayed pending a public hearing. Addition of riboflavin to the fortified grain premixes in use at present causes yellow blotches in rice cooked by steaming.

The ideal grain type premix should have rinse resistance for all ingredients, closely resemble a grain or broken grain of rice, and cause no spotting in the cooked product. The problems and progress to date in producing this ideal premix are reported. The use of the more soluble riboflavin-5′-phosphate sodium derivative rather than ordinary riboflavin has proved beneficial in speeding up the dispersion of riboflavin in the cooking process, thus reducing spotting. Myristic acid and polyethylene glycols are both effective as dispersing agents. Tricalcium phosphate,

calcium carbonate, or ferric pyrophosphate have been used successfully as color masking agents for the raw premix grains.

Premixes have been prepared which resemble broken rice grains closely and do not cause spotting on cooking. Rinse resistance for the ingredients other than riboflavin has been accomplished. The problem of full rinse resistance for riboflavin remains unsolved.

21

THE USE OF EMULSIFIERS AND EMULSIFIED OILS TO REDUCE COHESION IN CANNED WHITE RICE

R. E. FERREL

U. S. Department of Agriculture, Agricultural Research Service
Western Utilization Research and Development Division
800 Buchanan Street
Albany 10, California

Canned white pearl rice produced by the method of Roberts *et al.* (*Food Technol.*, **7**, 78–80, 1953) is subject to an undesirable degree of cohesion making it difficult to remove from the can and to separate into individual kernels during preparation for serving. Market tests indicate that the product otherwise has good potential as a commercial item. Two types of treatment to reduce cohesiveness of the canned rice have been developed.

Treatments of milled pearl rice either with emulsions of edible oils containing small amounts of emulsifiers or with certain food grade emulsifiers used alone during appropriate processing steps were investigated with respect to their effect on the cohesiveness of the canned product. Emulsions were prepared with different emulsifiers and in different concentrations of both oil and emulsifier, which were then applied at different steps in the processing. Cohesiveness was measured empirically by a standardized shaking test and expressed as the percentage of individual kernels separated from the contents of a can.

The kernel separation was increased from about 25% for untreated rice to the order of 90% for some of the treated rices. Uptake of oil by the rice is slight and taste-panel evaluations indicate no impairment of color, flavor, or texture acceptability.

22

THE EFFECT OF HEATING ON HISTOLOGICAL STRUCTURE RICE VARIETIES

RUBY R. LITTLE and ELSIE H. DAWSON

U. S. Department of Agriculture, Agricultural Research Service
Human Nutrition Research Division
Washington 25, D. C.

The microscopic structure of rice kernels and its bearing on some of the cooking characteristics of different kinds of rice have been investigated. In brown rice, structure and thickness of the pericarp and aleurone differ at different points of the circumference, influencing the position or manner of splitting of the kernels during cooking. In milled rice, cell structure and protein distribution in the starchy endosperm vary within a pattern, and may influence the manner of splitting or sloughing of the kernels when cooked. The structure of pericarp, aleurone, starchy endosperm, and germ attachment in several kinds of rice, and also starch, cell walls, and protein distribution in raw and cooked rice, as seen in bright-field, phase contrast, and polarizing microscopes, will be shown in slides.

23

RECENT DEVELOPMENTS IN SHORTENING

JOHN B. WOERFEL

Armour and Company, 401 N. Wabash Avenue
Chicago 11, Illinois

The raw material fats and oils used in shortening manufacture and the changing pattern of their use over the past several years will be discussed. The development of antioxidants and processes of lard rearrangement which have contributed to the increased usage of meat fats will be described in detail. The mechanism of the reaction as well as properties of the resultant products of rearrangement will be covered. Mention will be made of certain uses in cereal products for which unmodified lard offers benefits.

Currently there is considerable interest in the nutritional aspects of food fats. Attention is being directed to the quality as well as quantity. Literature covering the relationship of dietary fats to blood cholesterol level and other conditions will be reviewed and authoritative opinion cited. Reference will be made to the nutritional role of both saturated and unsaturated fats, as well as heat polymerized fats.

The estimated fatty acid composition of some typical shortenings will be presented and the effect of hydrogenation on fatty acid composition will be discussed.

Modified shortenings containing controlled amounts of specific fatty acids will be described and their functional properties compared with currently used products.

24

INDUSTRY VARIATIONS FROM CONVENTIONAL BREAD PROCESSING IN RECENT YEARS

REUBEN B. MECKEL

International Milling Company
Minneapolis, Minnesota

Conventional baking processes over relatively recent years will be briefly reviewed. Attention will be directed to outstanding advances made by the introduction of certain time and labor saving devices, and of equipment that has contributed to bread of improved quality.

Recent industry departures from conventional bread processing, such as Liquid Ferment and Continuous Mix Processes, will be examined and discussed. Points in which these processes resemble, and differ from conventional processing will be noted. Appropriate slides will be used for purposes of description and comparison.

25

DEINFESTATION OF WHEAT BY GAMMA IRRADIATION AND THE EFFECT OF DOSE LEVEL ON THE BAKING PROPERTIES OF THE FLOUR

EVERETT J. JACKSON, JR., FLORINDO F. DAL PAN, and STEPHEN A. FRIEDMAN

Curtiss-Wright Corporation, Research Division
Quehanna, Pennsylvania

Wheat infested with adults, pupae, larvae and eggs of various weevil, beetles and moths were irradiated with Cobalt 60 at levels of 10,000 to 30,000 rep. Life cycles were broken at 20,000 rep. There was no indication of reproduction at levels of 20,000 rep or more. Lethal effects were not immediate but the larvae in particular became sluggish and their eating habits were reduced inversely to the dose level.

Bread made with yeast and cake made with baking powder were baked using flour irradiated at 20,000 and 40,000 rep to bracket the grain treatment. The controls were made from non-irradiated flour. The loaves and layers had lower levels of rise and smaller volumes with increasing levels of irradiation. There was no apparent difference in browning. The irradiated flour was baked at normal temperatures and cooking times. All baked products were considered acceptable in organoleptic tests. Some panelists preferred the slight nut-like flavor of the higher irradiated flour.

Adjustments may be necessary with home recipes to compensate for the decreasing density of the flour with increasing levels of irradiation.

26

SPONGE DRYING

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A new method is described for drying tomato, orange, apricot, applesauce, and other purees and concentrates. The materials are dehydrated in the form of foams having specific gravities from 0.2 to 0.7. The foam is spread on trays or on a belt and placed in a 130° F. to 170° F. air stream at atmospheric pressure. Products made in this way are easily removed from the drying surface, are easily reconstituted, and have substantially the flavor of the material prior to drying.

Foaming techniques, drying rates, moisture equilibria, and product acceptability are discussed. Limited data on storage stability are given for tomato powder.

27

A MICROSCOPIC STUDY OF THE STRUCTURAL CHANGES OF PEACHES AND PEARS DURING SOFTENING

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New Brunswick, N. J.

Five varieties of peaches and 2 varieties of pears were studied by light microscopy and electron microscopy to determine the structural changes of the flesh during softening.

For the light microscopic study, the samples were embedded in paraffin after fixation in FAA. The embedded samples were cut into 5–7 micron sections.

For the electron microscopic examination, the samples were fixed in Osmium tetroxide, followed by dehydration. For dehydration of the fixed samples, both the alcohol immersion and freeze-drying methods were used. The fixed samples were embedded in the mixture of Epoxy Resin and dodecenyl succinic anhydride with or without the addition of the plasticizer, dibutyl phthalate.

The photomicrographs indicate that the thickness of the flesh cell walls decreases with the progress of softening.

During the softening of pears, there seems to be a relationship between the ease of cell separation and the decrease in the firmness of fruits.

The electron micrographs indicate that the cell walls of pear flesh seem to be decomposed when the fruit becomes very soft.

28

SWEETNESS AND ACIDITY ADJUSTMENT IN CANNED BARTLETT PEARS

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In California, Bartlett pears for canning are grown in 3 different areas with regards to geological and climatic conditions. These environmental variables result in differences in chemical composition of the fruit which have an important effect on the flavor quality of the canned product. Total acidity and/or soluble solids content of the canned fruit have been adjusted at the time of processing to increase the acceptability of those fruits which have been grown in areas which affect low acid and/or low sweetness level naturally.

29

SUGAR DISTRIBUTION IN PLANT TISSUES COOKED IN SYRUP

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Detailed cytological studies were made of microscopic sections of peaches (which had been cooked or canned in syrups with radioactive sugars). These were compared with autoradiographs prepared from the same sections. Radioactivity was predominantly localized in the cell walls. Thicker cell walls (e.g., in the vascular bundles) had a higher concentration of radioactivity than did thinner ones. The data indicate an adsorption of the sugars by the cell wall, presumably against a concentration gradient.

30

ANTHOCYANASE ACTIVITY AND ITS POSSIBLE RELATION TO SCALD IN SOUR CHERRIES

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Scald in sour cherries is characterized by a migration of the red anthocyanin pigment from the skin into the flesh of the fruit, followed in turn by the loss of the pigment and the appearance of a brown discoloration. Sour cherries contain an enzyme system capable of causing the destruction of anthocyanins, which is similar in many respects to the anthocyanase of Coleus plants, and dissimilar to fungal anthocyanase.

Sour cherry anthocyanase can be prepared from homogenates of fresh fruit or by means of acetone powders. The enzyme has limited solubility in water, and exhibits maximum activity at pH 5.7–6.0. The enzymatic activity of a homogenate of fresh cherries is approximately doubled by the inclusion of catechol in the reaction mixture, while purified enzyme preparations are almost completely inactive unless catechol is added. The optimum concentration of catechol is 0.01 M; higher and lower concentrations result in lowered enzymatic activity. The requirement for oxygen by this enzyme system was established through the use of Thunberg tubes. No decolorization was obtained in the absence of oxygen. Furthermore, after heating the reaction mixture for five minutes in a boiling water bath no decrease in color was seen on subsequent incubation in air.

The presence of anthocyanase has also been demonstrated in sweet cherries, black raspberries, blackberries, and blueberries. The amount of enzyme activity present in these fruits at several stages of maturity has been studied.

31

THE EFFECT OF BORATES AND OTHER INHIBITORS ON ENZYMATIC BROWNING IN APPLE TISSUE

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and
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Factors affecting the activity of borates as inhibitors of enzymatic browning were investigated. The activity of borates was not affected by pH. It was observed that there was a favorable interaction of sodium tetraborate (STB) with disodium phosphate, ascorbic acid, sodium chloride, sucrose and sodium bisulfite. The combination of borate with one or more of these other compounds would effectively inhibit the browning in apple slices.

Acceptability tests with a taste panel showed that slices treated with SO_2 (100 p.p.m.) plus STB (0.50%) was significantly better in color and flavor than slices treated with SO_2 (100 p.p.m.) alone. The same was found to be true for slices treated with ascorbic acid (0.50%) plus STB (0.50%) vs. ascorbic acid alone (0.50%).

It was shown with purified systems that the borates inhibited enzymatic browning by complexing the ortho di-OH group of polyphenols.

32

THE RECOVERY OF METHYL ANTHRANILATE IN CONCORD GRAPE ESSENCE

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Full flavor powdered Concord grape juice, even though a very acceptable product, is noticeably deficient in the "grapy" flavor long attributed to the methyl anthranilate which is present in the fresh juice in concentrations of 2 to 3 p.p.m. Analyses of normal 150 fold essences used to restore aromas to concentrates have shown that recoveries of methyl anthranilate are generally low; recoveries have been even lower in 900 to 1000 fold essences which are required to flavor powdered juice.

Work on a model system showed that in distilling the three components ethanol, methyl anthranilate and water (three normal components of grape essence), the recovery of methyl anthranilate was inversely related to the ethanol content of the essence. At concentration of ethanol above 55–60%, the recoveries dropped off very rapidly to the point that at 90% ethanol, the methyl anthranilate concentration was zero. Methyl anthranilate has a boiling point of 512° F. at 1 atm. It can be concentrated by distillation in low concentrations only because it has an abnormally high vapor pressure due to its partial miscibility with water. Solubility data of the three component system, however, showed methyl anthranilate to be completely miscible in a solution of 60% ethanol in water. Thus, as methyl anthranilate rises above the feed plate in a continuous distillation column and encounters high ethanol concentrations, in which it is completely miscible, its vapor pressure is reduced to a low value preventing it from distilling over.

High fold Concord grape essence from juices containing 0.05 to 0.1% ethanol must be made by removing the methyl anthranilate as a side stream and later combining it with the highly volatile constituents which distill over.

33

THE CONSTITUENTS OF THE CRYSTALLINE DEPOSITS ON DRIED FRUIT

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A "sugar-like" deposit is occasionally formed on dried fruit (particularly prunes and figs) during storage prior to processing and is sometimes found in the packaged products.

The compositions of these "sugars" have been determined by the use of paper chromatographic techniques. Deposits found on prunes and figs contained glucose and some fructose, traces of organic acids (mainly citric and malic) and traces of amino acids. Apricot "sugars" contained in addition to the compounds found on prunes and figs, some sucrose and relatively large quantities of arginine. Raisins contain glucose, fructose, tartaric acid and traces of other organic and amino acids.

Microbial examination did not reveal the presence of yeasts which had been previously reported as a constituent of the deposits.

34
STUDIES ON THE STORAGE DETERIORATION OF CALIFORNIA DATES

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The development of methods for improving the storage stability of California Deglet Noor dates has been hindered by the inadequate knowledge of deteriorative processes taking place in date tissue during storage. Consequently, a series of investigations have been undertaken to identify the chemical changes associated with the deterioration of dates, to determine the reaction systems responsible for these changes, and to ascertain the effects of environmental factors on these systems.

The present paper reports the results of storage studies in which the reaction rates of some of the overall chemical changes taking place were determined as a function of several environmental factors.

With low moisture dates the rate of oxygen and carbon dioxide gas exchange is only moderately effected by heating the dates prior to storage. The rate of browning as measured by decrease in reflectance or increase in extractable dark pigment is effected only slightly by heating or storage in a nitrogen atmosphere. The same is true for the rate of pH change. However, sucrose inversion which proceeds at a rapid rate in unheated date tissue is essentially absent in heated dates.

Details of the results of these and related studies in which the effects of moisture content and storage temperature were investigated will be discussed.

35
INFLUENCE OF VARIETY, MATURITY, AND STORAGE ON THE QUALITY OF CANNED APPLE SAUCE

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Sauce was manufactured during 3 processing seasons from apple varieties commercially important in the Appalachian area. Each variety, including York, Stayman, Golden Delicious, Rome, Jonathan, and N. W. Greening was harvested at 3 stages of maturity, subjected to both cold and common storage and removed from these storages at 4 different time intervals. Each time the raw apples were checked for resistance to puncture, resistance to shear, per cent AIS, per cent total pectin, per cent acid and water soluble pectins, starch, per cent total sugars, per cent total acidity, pH, ascorbic acid, per cent soluble solids, per cent total solids, color of the texterior and color of the flesh. They were then made into apple sauce which was packed in tin cans. These samples averaging about 80 per year were later evaluated for color, flavor, consistency, and texture by panels from industry, chain store buyers, and technologists.

These data have been analyzed statistically for differences and quality relationships.

36
CONSISTENCY AND SYNERESIS STUDIES WITH APPLE SAUCE

VERNER TOLDBY and ROBERT C. WILEY
University of Maryland
College Park, Maryland

Apple sauce is evaluated for quality on the basis of color, flavor, consistency, finish and absence of defects. These five factors are given equal importance in the U.S.D.A. grade standards. For this reason it is common practice in the manufacture of apple sauce to use blends of varieties, which will incorporate good color, flavor and texture into the sauce. Since the quality of the apples varies during the season, it is a problem to maintain uniform consistency, especially if the blends are selected mainly to give optimum color and flavor. Studies of consistency and syneresis in processed apple sauce, therefore is a key to good quality.

Consistency and syneresis are related to yield, and further, syneresis is closely related to the viscosity of the free liquor over a wide range of blends and processing conditions. Control of syneresis is possible inasmuch as the viscosity of the free liquor is adjustable by regulation of the acidity, pectin and starch content of the apple sauce.

Laboratory tests confirmed that apple sauce, made from blends selected to give optimum grade scores for color and flavor, improve in overall quality, if the natural acidity, pectin and starch content is adjusted to a more favorable level. This can be accomplished by the addition of malic acid, starch, and mixtures of high and low methoxyl pectins.

37
A RAPID METHOD FOR THE PRODUCTION OF A SPARKLING APPLE WINE

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Summerland, B. C., Canada

Established processes for the production of a sparkling apple wine (English cider) employ a process in which fermentation takes at least six weeks and storage of the fermented juice is in bulk. However, a rapid fermentation is more economical of equipment and adequate sanitation is more easily maintained. Preliminary studies showed that the flavor of a fermented carbonated apple juice, of approximately 6% alcohol by volume, was not injured noticeably by rapid fermentation at a relatively high temperature.

The object of this work was to produce a carbonated, fermented apple juice with a light color, and pleasant refreshing flavor, as economically as possible. The following process was finally developed. Sufficient 2% sulphur dioxide solution is added during the milling of the apples to give a final concentration of 100 p.p.m. SO_2 in the juice after pressing. The juice is then heated to 27.3° C. (85° F.), treated with commercial pectinase, and filtered. After filtration, the juice is sweetened to 16% soluble solids with commercial sucrose and a selected yeast culture is added. Fermentation continues to the desired end-point and is stopped by cooling. The fermented juice is filtered, carbonated, bottled, and pasteurized. The complete process can be performed in a week.

38
STUDIES OF BLENDING OF APPLE VARIETIES FOR FERMENTED APPLE WINE

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Fruit Processing Laboratory Experimental Farm
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Flavor evaluation of fermented apple wine (English cider) prepared from dessert varieties of apples have indicated that those found most acceptable have a total acid content of 0.37 to 0.45% expressed as malic acid, a refractometer reading of 8.2 to 8.5%, representing a total sugar content of 3.5 to 4.5% and an alcohol content of 5 to 6% by volume. A clean, piquant flavor is desired.

Dessert varieties grown in the Okanagan area of British Columbia may be classed as sharp (0.45% or more total acid as malic and less than 0.2% tannin) or sweet (less than 0.45% total acid as malic and less than 0.2% tannin). Owing to their low tannin content none fall into the bitter sweet or bitter sharp classification.

Jonathan, McIntosh, Stayman, Newtown and Winesap are sharp, while Delicious and mature Rome Beauty are sweet varieties.

To achieve the proper acid balance blends of sweet and sharp varieties in equal proportions, or in the proportion of 60% sweet to 40% sharp have been used.

McIntosh contributes an undesirable flavor to blends, and is not recommended.

Fruit left on the tree until mellow ripe, and fruit harvested at optimum storage maturity gave essentially the same quality in fermented apple wine. As length of storage of the fruit increases, total acidity of the wine prepared therefrom is found to decrease, while aromatic flavor constituents in the wine are found to increase.

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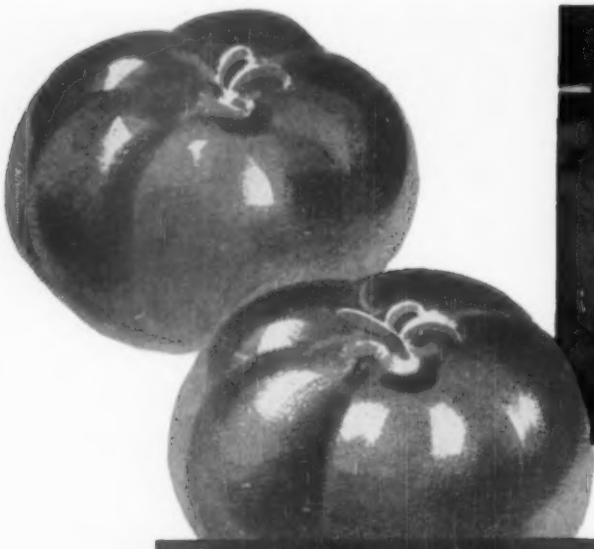
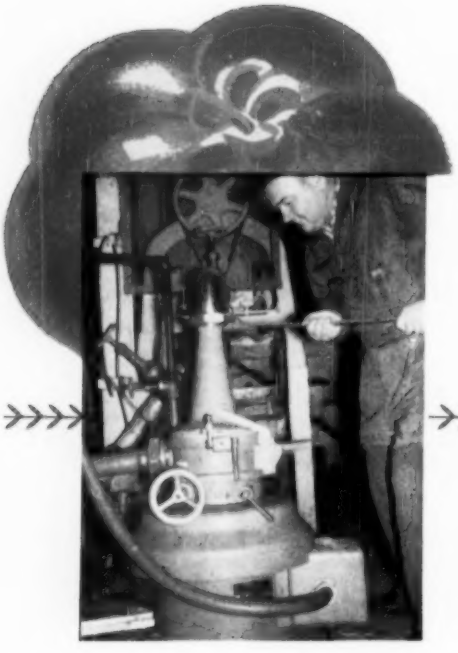


Edwin Fettig, President, and George Fettig of Fettig Canning Corp., Elwood, Indiana, and their Tomato MINCE MASTER.

"Tomatoes Emulsified in MINCE MASTER Retain More Natural Juices--More Natural Flavor! Make Better Catsup!"

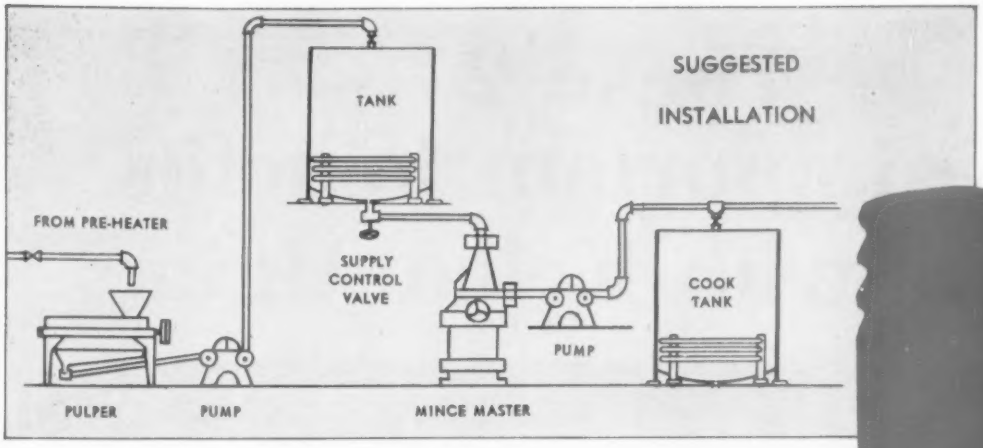
—Reports Superior Laboratories*

Juice processed through MINCE MASTER at Fettig Canning Corp., Elwood, Indiana, made catsup of higher viscosity! Better color! No separation of solids!



LEFT: George Fettig is tightening sanitary fitting on cone-shaped casting through which pulp enters the MINCE MASTER.

*RIGHT: R. A. Havens, Director of Superior Laboratories of Indianapolis, Indiana, who engineered and reported on MINCE MASTER installation at Fettig Canning Corp.



Superior Laboratories suggests positioning the MINCE MASTER as diagrammed above. It should discharge into a tank, large enough to prevent backup, or be connected to a pump of capacity that will not slow the discharge of processed fluid. Vacuum in cutting chamber must be maintained.

HIGHLIGHTS OF SUPERIOR LABORATORIES REPORT ON MINCE MASTER PERFORMANCE

- Produced in continuous run a volume of 80 to 120 gallons per minute, averaging 30 tons of tomatoes per hour.
- Examination of 100 samples of catsup, puree, and juice processed through MINCE MASTER showed no separation or settling of solids after 30 days.
- 200 samples of tomatoes processed through the MINCE MASTER, compared with unprocessed material from identical fruit, showed no increase in mold count.
- Experts judged catsup processed through MINCE MASTER to be of better color!

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39
POTENTIAL ECONOMIC IMPACT OF FOOD IRRADIATION

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Food irradiation will have major impacts on several key industries. It will introduce a new flexibility into processing, transport, storage, and marketing of foods. In the food processing industry, frozen food processors can expect to benefit most from its early impact, but canners may benefit to a greater extent in the long run. Fresh produce packers will probably experience a reduced share of the total food market. The perfected process will introduce whole new lines of products that will require added facilities for wholesaling, storage, and retailing. Consumers will be offered a greater selection of foods including procooked meats and prepared foods.

The need for particle accelerators and automated equipment will stimulate the market for electronic equipment and components. Initially, more refrigerated commercial storage equipment will be needed. Increased prepackaging of produce and meats should create an increased demand for more and better packaging.

These economic developments cannot be expected to take place until the process has been thoroughly tested and its economics of production better understood. It is anticipated that the mid- to late 1960's will be the earliest time that entry of irradiated foods ino civilian markets will take place.

40
TOOLING-UP FOR LOW-DOSE IRRADIATION PROCESSING OF FRESH FOODS

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Present day marketing of fresh foods has become more complex because centers of consumption are geographically far removed from centers of production. Hence extension of useful shelflife is assuming an ever increasing importance. Irradiation with doses in the 100,000 to 500,000 rad range, either alone or in conjunction with other methods, previously has been shown to be of promise as a useful tool for this purpose.

In the present investigation the technique of low-dose irradiation with supervoltage electrons was applied to several foods available in abundance on the West Coast with the aim of determining the variables that have to be understood prior to radiation processing on a commercial scale. Factors that have been considered include: handling of the food between harvest and irradiation, packaging, total dose, dose measurement, dose distribution, efficiency of beam utilization, auxiliary methods of shelflife extension, transport through the irradiation area, storage and distribution after irradiation, and market potential for the treated product. Design of and operational experience with a supervoltage electron beam facility capable of handling 2000 lbs. per hour at 200,000 rad will be described.

Results to date indicate that with careful control of variables, useful shelflike for certain economically important fresh foods can be extended as much as eight times with doses of 300,000 rad or less. In the cases investigated so far, such doses cause no discernible changes of desirable food qualities during a shelflife period which is commercially interesting.

With the experience gained, the sizeable capacity of the electron beam facility can be employed during the next crop-year for the irradiation of sufficent quantities of a single food to study the marketing of the product through commercial channels.

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DOSE DISTRIBUTION IN IRRADIATED SAMPLES

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It is important for the experimenter to know the dose distribution within an irradiated product. Factors affecting the dose distribution are the size, shape, material, and packaging of the sample, and the type, energy spectrum, and uniformity of the radiation field. Steps may be taken both by the experimenter and the source designer to improve the ratio of maximum to minimum dose in the sample by proper control of these variables. However, the responsibility rests with the experimenter to ascertain the dose distribution in the irradiated product. Dosimeters are presently available which, when properly applied, will supply this information.

The cellophane-dye dosimeter is particularly adaptable to the measurement of large dose variations which may occur in either accelerated electron or gamma ray sources. Techniques for the application of this dosimeter will be given. Using this dosimeter, the over-dose adjacent to the wall of a canned sample irradiated in spent uranium fuel element sources has been measured to be between 25 and 35%, depending on the age of the fuel element. This over-dose extends from the can wall into the sample with a tenth value depth of approximately 0.02 g./cm.^{2}

42
BIOCHEMICAL ALTERATION OF MILK PROTEINS BY GAMMA AND ULTRAVIOLET IRRADIATION

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The modification of milk proteins for the purpose of improving the digestibility and reducing the allergenicity has been investigated in the past by several methods, including enzymatic hydrolysis and heat processing. In the current studies, comparisons have been made of the effects of gamma and ultraviolet irradiation upon the biological and biochemical properties of milk proteins.

The chemical alterations in milk proteins resulting from gamma irradiation have been investigated, employing electrophoresis, viscosity measurements, and by determining changes in the concentration of sulfhydryl and disulfide bonds.

Skim milk, gamma irradiated to doses of 0.465, 2.79, 5.58 and 9.30 megarads has been tested on milk sensitized guinea pigs. The mean lethal shocking doses (LD_{50} values) were 36 ± 7 μg. of protein N for the non-irradiated milk and 29 ± 4, 64 ± 11, 602 ± 11, 602 ± 270 and $1{,}157 \pm 422$ μg. of protein N per 0.5 ml. challenging dose for the respective radiation doses. A sample of concurrent radiation distilled whole milk had an LD_{50} value of 131 ± 23 μg. of protein N. Raw skim milk irradiated for 3 hours with ultra violet light in the presence of hematoporphyrin, resulted in an LD_{50} value of $1{,}272 \pm 299$ μg. of protein N; without this photosensitizer, the LD_{50} was 228 ± 52 μg. of protein N per 0.5 ml. of challenging dose. The importance of these processing methods for the alteration in anaphylactogenic properties is discussed.

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RADIATION STERILIZATION OF FOOD. PART I. PROCEDURES FOR THE EVALUATION OF THE RADIATION RESISTANCE OF SPORES OF *CLOSTRIDIUM BOTULINUM* IN FOOD PRODUCTS

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The establishment of the radiation requirements for the commercial sterilization of food products presupposes a sound and reasonably accurate estimate of the maximum resistance to radiation of spores of *Cl. botulinum*. Procedures will be described which are believed to be suitable for the determination of the resistance of spores of *Cl. botulinum* in representative food products. These procedures involve the use of: a) normal product packed in 202 x 202 cans; b) high spore load inoculation (100,000,000 spores per can); c) irradiation of 20 can lots by a graded series of dosages; d) incubation at 85° F. for at least 6 months for the recovery of survivors capable of producing spoilage; e) verification of spoilage by toxin assay; f) after 6 months storage, examination of cans of the lowest dose level showing no spoilage for the presence of toxin and botulinum spores; g) calculation of radiation D values (dose of 90% destruction) from all levels of radiation showing partial spoilage. The suggested procedure will be illustrated by the presentation of the results of experiments with several different non-acid food products.

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EFFECTS OF ELECTRON BEAM IRRADIATION ON THE MICROBIAL CONTENT OF SPICES AND TEAS AND ON THEIR VOLATILE CONSTITUENTS

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The Geo. Williams Hooper Foundation
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Sweet basil, oregano, sage, allspice, chili pepper, cinnamon, cloves, paprika, ginger, black and cayenne peppers, nutmeg, and green, oolong and orange pekoe teas were given a 2 megarep dose of irradiation from an electron beam generator of the resonance transformer type. The content of bacterial and fungal organisms before and after the irradiation was determined on a number of samples of each product. The samples which were comminuted or powdered were completely freed from living microorganisms by the irradiation, whereas those in the leaf form, as sweet basil and oregano, showed a 97 to more than 99% destruction of their microbial population.

There was a noticeable effect of the irradiation on the odors of some of the materials and a corresponding change in the content of volatile reducing substances.

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PRODUCTION AND PREVENTION OF IRRADIATED ODOR IN BEEF

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A water soluble, non-dialyzable fraction has been obtained from boiled beef which when irradiated developed an odor nearly identical to that produced upon irradiation of raw beef. Odor production was found to be finite with respect to amount of irradiation dose and repeated exposures. When the fraction was freeze-dried and then irradiated, the typical odor was released only upon reconstitution with water.

Treatment of the irradiated fraction with sodium hydroxide, mercuric acetate, p-chloromercuribenzoate, or N-ethyl maleimide almost completely eliminated the odor. This indicates a relationship between sulfhydryl or closely related compounds and the irradiation odor. Ninhydrin and 2,4-dinitrophenylhydrazine did not quench the odor, making it doubtful that amino or carbonyl compounds are directly related to it. The addition of p-chloromercuribenzoate before irradiation substantially decreases odor formation.

Paper chromatographic studies have demonstrated that reagents such as 1-fluorodinitrobenzene, 3,5-dinitrobenzoyl chloride, 1-anthroquinone sulfonic acid, silver nitrate-bromphenol blue, and platinum iodide formed derivatives with compounds present in the irradiated protein but not in the non-irradiated control. Column chromatographic analysis revealed that cysteine and methionine can no longer be detected and that histidine content was reduced after irradiation of the protein.

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THE EFFECTS OF PRE-IRRADIATION HEAT INACTIVATION OF ENZYMES ON ACCEPTABILITY OF BEEF AND PORK

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Recent evidence has indicated that the enzymes present in irradiated meats must be inactivated to prevent undesirable flavor changes during storage. Thus, the effectiveness of different pre-irradiation enzyme inactivation temperatures upon panel scores, amino nitrogen, texture and pH were investigated for beef and pork. The meat was heated to internal temperatures of 145 or 150° F., 160° F., and 170° F. by using steam retort temperatures of either 212° F. or the desired internal temperature of the meat plus 10° F. until the specified internal temperature was achieved. The method of enzyme inactivation was without effect upon panel scores for all unirradiated controls, but following irradiation the higher external enzyme inactivation temperatures (212° F.) were preferred for the beef. With pork, lower external inactivation temperatures were preferred. Although mean scores showed the same trend after storage, differences in panel scores were no longer statistically significant following 3 months for pork and 6 months for beef. pH values for high external temperatures of enzyme inactivation tended to be lower for both pork and beef, but after 3 months' storage differences had disappeared. Although the method of enzyme inactivation was without effect on percentage of amino nitrogen in unirradiated controls, there was a greater percentage of amino nitrogen after irradiation in samples inactivated at the low external temperature. With pork, no clear-cut trend is evident. However, amino nitrogen values indicate that both methods of inactivation were adequate to prevent further proteolysis.

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COLOR CHANGES IN PIGMENT-FREE RESIDUES FROM GAMMA IRRADIATED GREEN BEANS, BROCCOLI, SWEET POTATOES, AND CARROTS

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The color of the pigment-free residues from gamma-irradiated green beans, broccoli, sweet potatoes and carrots, packed under a variety of conditions was investigated. The reactions responsible for the color changes were evident soon after irradiation and progressed slowly during storage. Green bean residues after eleven months storage were darker and showed a small hue change towards the yellow, whereas residues from broccoli, sweet potatoes and carrots were all darker and browner. Residues from all four vegetables showed less hue change when irradiated frozen as compared with room temperature and all except those from sweet potatoes were lighter in color. Residues from all four vegetables were darker and showed more color changes when packed in air as compared with those in vacuum or nitrogen, or when packed in water as compared with brine or syrup. Vegetables in plain tin cans had residues with higher reflectance values and less hue changes when compared with enameled cans. Vegetables stored at 100° F. had much darker residues with more hue change than those stored at 70° F. The reflectance and chroma values for the product and the residues showed positive correlations for all four vegetables. The hue values showed a negative correlation for green beans, broccoli, and carrots, and no correlation for sweet potatoes. This indicated that in the case of hue, at least, conditions that created a large color change in the product also created a large color change in the residues.

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EFFECTS OF IONIZING RADIATION ON GELATIN AND THE ROLE OF VARIOUS RADIOPROTECTIVE AGENTS

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The effects of ionizing radiation on gelatin under a variety of conditions were studied. Radiation damage was found to be modified by a number of factors. The presence of N_2 and the absence of moisture during irradiation did not have any effect in minimizing radiation damage. The heat from irradiation had no deleterious effect on the physical properties of gelatin. The reduction in bloom-gel strength and viscosity due to irradiation were minimized by the addition of additives suitable for food use. A few of the mechanisms which may be responsible for this protection are discussed.

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PRESERVATION OF PACIFIC COAST SHELLFISH AND SMOKED FISH WITH IONIZING RADIATIONS

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The purpose of this study was to determine the acceptability of certain seafoods after exposure to various levels of ionizing radiations. The following shellfish were selected: crabmeat, shrimp and oysters. The cured fishery products consisted of the following: kippered sablefish, sturgeon and salmon. The samples were irradiated in the frozen state at 0.1, 0.25, 0.50, 0.75, 1.0, 1.30, 2.0, 3.0 and 4.5 megarads. Extension of storage life at the predetermined temperatures 45°, 70° and 100° F., as well as changes in color and flavor, was briefly examined.

The results obtained indicate that shrimp, blanched oysters, kippered sturgeon and sablefish yield acceptable irradiated products. No obvious bacterial spoilage was observed in any of the products irradiated at a level of 1.0 megarad or higher. The carotenoid pigments in crab and fresh shrimp were quite resistant to destruction by ionizing radiations. This is in contrast to the results obtained with raw, kippered and smoked salmon.

A method of determination of volatile oxidizable substances has promise as a procedure to measure the intensity of irradiation odor in certain seafoods.

Ionizing radiations appear to hold much promise as a future method for the pasteurization and preservation of many seafoods.

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ANTIOXIDANTS IN IRRADIATED COOKED PORK

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Oxidative changes followed by the TBA reaction have been shown to occur in fresh pork upon cooking, increasing with time. Oxidative changes also contribute to the off-odor and flavor of fresh pork, irradiated with 2,000,000 rad of γ-irradiation.

The effect of different antioxidants and copper chelating agents as synergists, in fresh pork, cooked at 70° C. prior to receiving 2,000,000 rad of irradiation dose, has been studied. As shown by the TBA reaction and statistical evaluation of taste panel results, the rancid odor produced by the oxidative changes has been eliminated. The irradiation off-odor is still present in the product, but this was not as objectional to the panel as the rancid odor of the cooked, untreated,non-irradiated fresh pork.

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THE INFLUENCE OF FAT CONTENT ON THE PALATABILITY OF IRRADIATED BEEF

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Previous studies on the palatability of irradiated beef have indicated that the variation in flavor may be due to the character of the meat utilized in the experiment. Most of these studies have given little importance to the origin of the meat, its fat content or the conditions under which it was handled. It is felt that each may play a very important part in the palatability after irradiation. The conditions under which the meat was handled prior to irradiation may significantly influence the subsequent storage life of the product.

Evidence is presented as to the effect of animal maturity, fat content, storage temperature, storage time and irradiation dose on the product acceptability. Ground beef from choice and standard grade carcasses was used in this study. The fat content varied by 10%. Ground beef having a low fat content was considered to be more palatable than ground beef having a greater amount of chemical fat. Storage studies further indicate that lean beef will remain acceptable for a longer period than that having a greater quantity of fat. The amount of fat in the meat was found to have as much effect upon the acceptability of the stored irradiated meat as the irradiation dose level.

Loin steaks from animals ranging in chemical fat from less than 1% to 6% have also been studied. The effect of fat content on the flavor, juiciness and tenderness of the irradiated steaks is presented.

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MAPLE SIRUP. XIV. ULTRAVIOLET IRRADIATION EFFECTS ON THE GROWTH OF BACTERIA AND YEASTS

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A study was made of the destructive effect of ultraviolet irradiation on yeast and bacteria. The variables investigated were irradiation dosage (time of exposure, lamp wattage, and distance to light source), method of irradiation (continuous and discontinuous exposure with stationary and flowing systems), temperatures of incubation and strain of organisms. The effects of the variables were determined by use of statistically designed experiments and the data evaluated by an analysis of variance.

The analysis of variance showed that the effect of dosage was significant at the 1% level for both he bacteria (pseudomonads) and yeast *(Cryptococcus albidus)*. The effect of the method of irradiation was significant at the 1% level for the bacteria but not for the yeast, while temperature effect was significant only for the yeast. In all cases the yeast was the least sensitive to ultraviolet irradiation.

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RADIATION PRESERVATION OF MILK. IX. STUDIES ON THE IRRADIATION INDUCED GELATION OF CONCENTRATED MILK

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The effect of different additives on the gelling time and gel strength of 3:1 concentrated-irradiation-sterilized milk during storage at 37°C has been studied. Several additives such as polyphosphates and metal ions were found to inhibit gelation. The effect of irradiation on the ion balance has been studied and analytical data are presented. The implications of the findings are discussed.

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TREATMENT OF ONIONS AND POTATOES WITH GAMMA RAYS: EFFECTS OF DELAY BETWEEN HARVEST AND IRRADIATION

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Hybrid onions of the Southport White Globe type were stored at 70° F. before and after irradiation with various dosages of Co^{60} gamma rays. In lots irradiated 2 weeks after harvest as little as 2 kilorads was sufficient to inhibit subsequent sprouting almost completely. However, when irradiation was delayed until 11 or 17 weeks after harvest, there was little inhibition by doses ranging from 2 to 250 kilorads, and in some cases sprouting was accelerated. The highest dosage increased losses from softening of the bulbs. Idaho Russet Burbank potatoes harvested in October were stored at 40° F. Six, 22, and 32 weeks after harvest separate portions of this lot were exposed to 11 kilorads of gamma rays and then returned to 40° F. In June, all tubers were transferred to 70–74° F. storage. During the next 9 weeks the controls sprouted extensively, while in the irradiated potatoes sprouting was largely but not completely suppressed. What little sprouting occurred was approximately equal in the 3 sublots irradiated at different times. Data are presented on total and reducing sugars and chipping quality of the irradiated tubers.

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PRODUCT-INDUCED STRATIFICATION OF COVERING SYRUPS

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This paper summarizes the findings and conclusions of a two-year study on the mechanism of product-induced stratification of covering syrups in several foods, principally fresh cucumber pickles, and the effect of this stratification on the heating characteristics.

The studies were in two parts. Model systems in which the heating rates at several points in jars containing only water and sucrose in artificially produced layers were studied (e.g. bottom half of the jar 50% sucrose syrup and top half water); these model systems were then modified by introducing plastic rods cut to the size and shape of a cucumber spear and again determining heating rates. A study was made of the dynamics of formation and destruction of stratification in sweet, fresh cucumber spear packs from the time the syrup was poured over the spears, through the pasteurization process, to the final equalization. In 16 oz. jars of sweet cucumber spears there was still an 8% soluble solids difference between the top and bottom of the jar after 32 days.

The results of the model system studies showed that, although an all-water pack heats faster at every corresponding point than all-syrup pack (f_h of 8.8 min. vs. 10.1 min.), when layering is artificially induced, no convective transfer of liquid takes place across layer boundaries, with the result that heating rates, f_h's, increase markedly throughout the jar (e.g. 10 min. to 17 min.) in both water and syrup layers.

The results of the actual product studies showed that most of the water leaving the cucumbers, rather than mixing with the surrounding syrup, rises at once to the top of the jar; further, that this stratification begins the moment the syrup is poured over the product and continues during pasteurization; that maximum stratification (maximum difference between top and bottom sucrose concentration) occurs at about 24 hours for cucumber spears; and that the rate of formation of stratified layers is not appreciably upset by convective currents; that is, there are almost no convection currents in a stratified pack. Needless to say, a jar with no convection currents heats by conduction: the heating rate (f_h) of fresh cucumber spears in brine is 21 min. and in syrup is 40 min.

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LOW TEMPERATURE HANDLING OF STERILIZED FOODS. I. DESIGN OF EQUIPMENT AND PRELIMINARY INVESTIGATIONS

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Two systems for the High Temperature Short Time Sterilization of low acid products recently designed and placed into operation are discussed. The first system consists of a batch operation for the production laboratory size quantities of HTST sterilized products. The second system is semi-automatic and capable of processing material by several different procedures which are feasible for commercial application. Both systems are capable of handling liquid, semi-liquid and discrete particle products.

Products packed so far include green beans, green peas, whole kernel corn, cream style corn, asparagus, tomato juice, oyster stew soup, vegetable beef soup, green pea with ham soup and evaporated milk. Equal allotments of each product packed were processed by both conventional commercial methods and High Temperature Short Time Sterilization. Of each product, about 11% of the material, sealed in cans, was frozen and stored at 0° F. Approximately the same quantity of each product, processed by each of the two methods of sterilization were stored at 85° F., 50° F., 35° F., and 25° F. A measure of the initial flavor and color of each of the products was made. Quality examinations of each product are made after 3, 6, 12, 18 and 24 months storage. Results obtained from a number of these evaluations are discussed briefly.

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FRIGI-CANNING

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Frigi-canning may be defined as the preservation of succulent foods by enough heat (boiling temperature) to kill all vegetative micro-organisms, hermetically sealing at the boiling temperature under aseptic conditions and storing as low as possible without freezing, thus preventing spore germination.

Originally it was thought of mainly as a method for home gardeners to preserve their surplus for off-season use. For this purpose, pint Ball-Mason jars in boiling water from one kettle were filled with vegetable from another kettle after they had boiled 5 minutes, immediately sealing the jar and placing back into the boiling water. When all were filled cold water was started into this kettle as fast as possible to prevent cracking the glass. In 2 minutes a full stream was possible. The product was then stored at refrigeration temperatures (32° F. preferred) but the village refrigerator's precooling room was all that was available and there 38° F. was common.

This has now been done yearly since 1942 except for 3 years of absence. The results have been so satisfactory that it is believed to have commercial possibilities. For example, a canner who might wish to supply large consumers, restaurants and hotels, where the storage temperatures could be under rigid control. Such products have the characteristics of fresh-harvested garden vegetables, kitchen cooked.

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THERMAL RESISTANCE OF MICROORGANISMS TO DRY HEAT: DESIGN OF APPARATUS, OPERATIONAL PROBLEMS AND PRELIMINARY RESULTS

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An apparatus and technique developed for studying the dry heat (e.g., superheated steam or air) resistance of bacterial spores is described. This apparatus makes possible dry heat resistance studies under controlled time and temperature conditions: time ± 0.1 min. and temperature ± 1.0° F. The system is not limited to superheated steam or air but can use any non-combustible gas as the heating medium. The gas is heated with an electrical heater prior to entering the testing apparatus and is vented to the atmosphere after passing through the system. A flow pressure of about 1 p.s.i.a. is maintained through the entire system which gives a pressure of about 0.5 p.s.i.a. in the testing chamber. The heating plus cooling lag correction factors vary with flow rate and heating medium; for superheated steam under average condition the lag correction factor is 0.20 min. The apparatus has been operated to temperatures of 380° F.; however, actual bacteriological testing has been limited to the temperature range of 310° F. to 345° F.

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PROBLEMS IN THE PREPARATION AND HANDLING OF HOT VENDED CANNED FOODS

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The vending of hot foods in cans which represents an entirely new market for the food industry has posed several problems both to the processor and to the vendor.

Serious bacteriological problems as well as quality deterioration may result from the storage of products at elevated temperatures in the vending machines. This imposes severe bacteriological restrictions in order to prevent thermophilic spoilage and careful maintenance of equipment and control of ingredients is essential. Product reformulation is often necessary in order to maintain proper quality levels under the severe storage conditions.

The major obstacles in the vending of hot canned foods include sanitary opening of the cans, handling the hot cans after opening and the possible consumer resistance to eating out of cans. These aspects of hot vended foods as well as product reformulation and bacteriological control and their possible solution will be discussed.

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INFLUENCE OF BLANCHING CONDITIONS ON SLOUGHING, SPLITTING AND FIRMNESS OF CANNED SNAP BEANS

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A condition sometimes found in canned snap beans is sloughing, a loosening of the skin which can be easily rubbed off the pod. In severe cases loose skins are seen when the beans are removed from the can. This condition leads to a downgrading of the product and serious economic loss. Using objective methods of evaluation we have studied the effect of blanching on the degree of sloughing found in beans cooked for 20 minutes at 240° F. in No. 303 cans.

Beans were blanched at temperatures from 150° F. to 210° F. with the result that as the temperature was raised the amount of sloughing increased. The duration of the blanch was also a factor in determining the degree of sloughing. When blanching was carried out at temperatures below 180° F. increases in blanching time led to less sloughing, while at temperatures above 180° F. greater sloughing was seen as the result of longer blanching times. The toughening effect of low temperature blanching continued during the interval between blanching and cooking and was enhanced by holding the blanched beans at moderately high temperatures. This toughening process could be halted by the use of a second blanch at 190° F.

In the course of this study it became evident that the blanching process also affected the tendency of the beans to split. This took place in such a manner that blanching conditions which caused an increase in sloughing also caused an increase in splitting. In addition the firmness of the canned beans was altered resulting in very firm beans when low temperature blanches were used, whereas higher temperatures, above 190° F., led to extremely soft beans.

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FOOD BLANCHING—ITS ROLE IN FOOD IRRADIATION

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Blanching procedures for vegetables which are to be irradiated should not be greatly different from those used for other methods of preservation. With flesh-type products, blanching prior to irradiation must be carried out with greater precautions, since it is desirable to inactivate proteolytic enzymes without overcooking. With fish, it is not only desirable to destroy proteolytic enzymes prior to irradiation but also to leach out compounds which may take part in the Maillard reaction. Investigations car-

ried out at Geneva, Switzerland, would indicate that adrenalin injection of animals may obviate the necessity for heating meat products to destroy proteolytic enzymes, but this method must be further evaluated.

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BLANCHING IN FREEZING PRESERVATION

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Blanching is a vital step in the preparation of vegetables for freezing preservation. This may be accomplished by processes involving the use of boiling water or steam. Other methods have been tried, but the two mentioned are of the greatest practical importance.

Changes which take place during blanching are notably losses in minerals, vitamins, and other water soluble substances.

Adequacy of blanching prevents enzymic changes from taking place during storage, and numerous tests have been devised to determine the completion of the destruction of the enzymes in a given sample. Most of these tests are for catalase or peroxidase.

Unblanched and insufficiently blanched material show adverse changes in color, odor, and flavor during storage, and recent work indicates that this is caused by changes, rancid in nature, in the lipid matter.

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THE INTERACTION BETWEEN BLANCHING AND DRYING RATES OF PEAS

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Samples of Perfected Freezer peas were harvested over 8 days, size graded and the peas of each size grade were divided into lots for blanching in water at 212° F. for 1, 2, 4 and 8 minutes, or in steam for 2 minutes under 0, 2, 4, 8 and 16 p.s.i. steam pressure. The blanched samples were then frozen and later thawed, slit and dehydrated under standard conditions. The loss of moisture during drying was measured on each sample by frequent weighings. These data were then related in drying time in terms of $\sqrt{\frac{1}{\text{lbs. } H_2O/\text{lb. B.D.S.}}}$ and the slope of the line of best fit was measured as Angle θ which then represented the drying rate of a sample.

On relating the drying rate to blanching condition it was found that increasing the water blanching time up to 4 minutes hastened drying and thereafter there was little effect on drying rate. Blanching in steam caused a progressive increase in drying rate as the steam pressure was increased. Greater gains in drying rate were obtained by increasing steam pressure during blanching than by prolonging the blanching time in water.

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ANTIBIOTICS IN POULTRY MEAT PRESERVATION: *IN VITRO* DEVELOPMENT OF BACTERIAL RESISTANCE TO CHLORTETRACYCLINE

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The tetracycline antibiotics (chlortetracycline and oxytetracycline) have been widely used in this country for assisting in extending the shelf-life of chilled poultry. Previous work by the present authors has shown that many of the microorganisms isolated from spoiled poultry processed in plants using chlortetracycline (CTC) routinely were resistant to higher concentrations of antibiotic than those isolated from birds from plants where no antibiotic was in use. These observations prompted the present study to determine if the resistance of the bacteria to the antibiotics could be increased *in vitro*. Therefore, 25 cultures previously isolated from spoiled chickens were subjected to a training routine in which they were transferred into progressively increasing concentrations of the antibiotic. It was found extremely difficult to train cultures which initially were very sensitive (no growth at 0.25 p.p.m.). The maximum concentration which did not inhibit growth of some of these organisms was 4 p.p.m. (following 4 months continuous training). In a number of cases no increased resistance could be demonstrated. Some of the less sensitive cultures were trained to grow in the presence of concentrations of at least 480 p.p.m. of CTC. Evidence has been obtained that indicates the resistance increase is gradual as opposed to a one step mutation which has been described for streptomycin.

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MICROORGANISMS RESPONSIBLE FOR SPOILAGE OF COMMERCIALLY PROCESSED CHILLED POULTRY

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In studies made by other workers on the spoilage of refrigerated poultry, isolations invariably have been made at 68° F. or higher. Under commercial conditions the spoilage occurs at much lower temperatures (34–50° F.). Therefore, it was felt that an isolation temperature of 68° F. or higher might have influenced the distribution of the types reported in the literature. In order to get a more realistic picture of the organisms associated with spoilage of poultry meat at low temperatures, a study was undertaken in which all isolations were made at 40° F. from cut-up tray-packed poultry purchased from markets in the Sacramento area. A total of 103 cold tolerant cultures were isolated. Of these 84 were motile, possessed polar flagella and other characteristics which allocated them to the genus *Pseudomonas*. Four non-motile cultures also possessed characteristics common to members of the genus *Pseudomonas*. It is interesting that only 13 of the 88 organisms classified as members of the genus *Pseudomonas* produced a water soluble yellow-green fluorescent pigment. One additional gram negative fermentative pseudomonad was assigned to the genus *Aeromonas*. The fourteen remaining cultures were represented by twelve *Achromabacter* or *Alcaligenes* types and two unidentified cultures. Of all the isolates less than 10% were capable of growth at 98.6° F. (37° C.). The predominance of *Pseudomonas* types on spoiled chilled poultry confirms reports of previous workers.

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RELATIONSHIPS AMONG pH, WATER CONTENTS, AND TENDERNESS IN TURKEY MEAT

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In 3 experiments the following observations were made during a post-mortem aging period on the dressed carcasses of turkeys of 2 ages and 2 breeds: Moisture uptake and loss during aging; total, bound, and free water in the pectoralis major muscle tissue; pH as determined *in vitro*, and tenderness as measured by the Kramer Shear press.

The carcasses were aged for 0, 2, 5, 8, 12, and 16 hours after slaughter in slush ice, or in a walk-in cooler at 90% relative humidity and 34° F. Those carcasses aged in air were either unpackaged or loosely packaged in polyethylene.

Within the limits of this experiment, no apparent relationship was observed between total water, free water, or bound water and tenderness. A relationship was observed between pH and tenderness, but as to whether it was causative or not is not yet determined. Moisture uptake or loss produced no apparent effect on the total water in the breast muscle tissue.

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DISTRIBUTION OF METHIONINE AND CYSTINE IN POULTRY MEAT

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Methionine and cystine levels were determined in the light meat, dark meat, gizzard, liver, heart and skin of 9-week-old fryers of known source. Amino acid determinations were made on samples from which fat had been extracted prior to a 6-hour sealed tube acid hydrolysis. The assay organism, *Leuconostoc*

mesenteroides P-60 ATCC No. 8042, was incubated for 72 hours prior to acidimetric readings.

The methionine content of light meat was almost 3% of the total protein. The percentage of total protein present as methionine was dark meat, 2.90; gizzard, 2.82; heart, 2.75; liver, 2.42; and skin, 1.71. The cystine content was in exactly the opposite order of magnitude than methionine except for skin which was low in both cystine and methionine. The total content of cystine and methionine was approximately equal for all parts of the carcass tested, except skin.

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RESAZURIN REDUCTION TESTS FOR SHELF LIFE ESTIMATION OF POULTRY MEAT

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A test for the predictability of shelf life of poultry meat was investigated in which reduction of resazurin dye was used as the indicator. Comparisons between sampling skin surface by the swab technique and by a newly developed sampling device were also studied. These tests showed that, using the red end-point, a reduction time of 2 hours or less may be expected when birds are near odor development stage. Values may be assigned to reduction times which should indicate the expected remaining shelf life of poultry meat. The sampling device was found to be more accurate than the swab in estimating members of bacteria from defined areas.

The treatment of poultry meat with antibiotics of the tetracycline group did not appear to have a demonstrable effect on changing reduction times compared to untreated birds.

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TENDERNESS AT VARIOUS MUSCLE DEPTHS ASSOCIATED WITH POULTRY PROCESSING TECHNIQUES

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Effects of various scald-time-temperature combinations on the tenderness characteristics of *Pectoralis major* muscle fibers at several distances from the surface were determined. Chickens were aged in an ice and water solution for 24 hours. They were then wrapped in aluminum foil and placed in an oven at 325° F. for 2 hours. All cooked birds were cooled to 34° F. prior to removal of the breast muscle. Three slices, each 2 mm. thick were cut from the exterior surface using a commercial meat slicer. From these slices 2.5 x 6.5 cm. samples were taken and subjected to a tenderness determination using a Kramer Shear press.

Resistance to shear was closely related to the depth at which samples were taken, as well as to the scald treatment given the birds. In general the exterior layers required over twice as much force to shear as did the innermost layers.

This paper describes the tenderness pattern obtained by varying scald process techniques and also describes an objective method for measuring meat tenderness with relatively small samples.

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DONENESS OF FROZEN, DEFROSTED TURKEY HALVES ROASTED TO SEVERAL END POINT TEMPERATURES

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Eighty frozen defrosted Broad Breasted Bronze turkey halves were roasted at 163° C. (325° F.) to end point temperatures of 85° and 90° C. in the *Pectoralis major* and 85°, 90° and 95° C. in the thigh muscles. The hen turkey halves weighed between 5½ and 8 pounds and were defrosted at room temperature previous to roasting.

Generally, the turkey halves cooked to an end point temperature of 85° C. in the thigh were underdone. Those roasted to 85° C. in the *Pectoralis major* and 90° C. in the thigh were similar in doneness but less done than those roasted to 90° C. in the *Pectoralis major* or 95° C. in the thigh. The birds in the latter two groups also were similar in doneness. Turkey halves roasted to either of these last two end points were in the oven between 25 and 27 minutes per pounds and were satisfactorily done.

Flavor and tenderness scores were similar for birds cooked to all end point temperatures. Juiciness scores and press fluid yields were lower and cooking losses higher for the turkey halves roasted to 90° C. in the *Pectoralis major* and 95° C. in the thigh than for those cooked to the other end point temperatures.

The amount of heat coagulable protein nitrogen present in the cooked *Pectoralis major* was not related to the doneness of the birds.

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DEVELOPMENT OF THE POULTRY INSPECTION ACT

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The purpose of this Law is to establish compulsory inspection by the Federal Government of poultry and poultry products in interstate commerce. Several years ago the Institute of American Poultry Industries established a Study Committee to evaluate the need for compulsory inspection. The Institute has long favored sound mandatory inspection and was on record in this regard prior to the passage of Public Law 85–172, the Poultry Products Inspection Act, approved August 28, 1957. The Institute believes the Poultry Products Inspection Act to be among the most constructive efforts of the U. S. Congress. The Law requires antemortem inspection and post mortem inspection of each carcass processed in an official establishment. The Law and related regulations cover sanitary and labeling requirements and there are a prohibited acts section and a penalty section. The administration of this program is under the control of the Secretary of Agriculture and his subordinate, the Director of the Poultry Division of the Agricultural Marketing Service. The transition from noninspection to inspection has been quite smooth and those in the poultry industry look upon mandatory inspection as another tool for improving quality.

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OXIDATIONS IN MODEL SYSTEMS RELATED TO DEHYDRATED FOODS

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Recent developments of quick-serve dehydrated ration items have emphasized the need for methods of inhibiting deteriorations of the dispersed fats and of interactions of deterioration products with other food components. In order to study these problems in their most general applications, model dehydrated emulsion systems were designed to simulate dehydrated food hydrocolloids and were studied under accelerated storage conditions.

Dehydrated fatty emulsions with an inert carbohydrate matrix were used to evaluate the roles of proteins, phospholipids, and of iron compounds in lipid oxidations. Phospholipids, in amounts from 0.5 to 5% of dry weight protected against oxidation. Iron compounds promoted oxidations, especially hemoglobin, which in the range of 5–100 p.p.m. of iron, caused spontaneous combustion of the samples within minutes at 85° C. Hematin, the iron pigment of hemoglobin, had a similar effect but at a slower rate. When dispersed in oil only, the relative rates of hemoglobin and hematin were reversed, and the overall reactions, measured by peroxide and thiobarbituric acid values were much less than for the dehydrated emulsions. The proxidant effects of ferric citrate and ferric chloride was very small compared to that of the porphyrin compounds.

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FACTORS INFLUENCING THE ABSORPTION OF POTATO FLOUR

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Potato flour is the oldest commercial form of processed potato. Its growth and development has been considerably slower than other segments of the food processing industry. A number of investigators have reported its use in bakery goods but relatively few results have been published in respect to improving its quality.

The purpose of this investigation is to evaluate the various factors influencing the absorption of potato flour. An absorption test was developed using a Brookfield Viscometer. An objective method for measurement using this viscometer was sought. Several major factors were considered: (1) shear stress vs. rate of shear; (2) mixing to prevent lumping; (3) temperature and (4) concentration. Slides will be presented showing the various modifications made in the mixing apparatus and in the Brookfield Viscometer.

With the apparatus meeting all the required qualifications, studies were made using (1) varying cooking temperatures and cooking times (2) emulsifiers at various concentrations (3) raw potato with varying solids content and (4) various granule sizes.

The Brabender Visco/amylo/Graph was also used in this study for correlation with the Brookfield Viscometer. Both the Brookfield and Brabender Visco/amylo/Graph charts will be presented and an attempt will be made to elucidate and explain the behavior of potato flour under the various conditions of potato flour manufacture. The Idaho Russet Potato was used throughout this study.

The ultimate objective of this study is to obtain a superior potato flour manufacturing process which will result in a flour having constant absorption properties and to stimulate interest among potato flour manufacturers to attack other closely related problems.

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POLYPHENOLIC CONTENT AND ENZYMATIC ACTIVITY OF TWO VARIETIES OF POTATOES AS AFFECTED BY MATURITY AND STORAGE

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Pontiac and Ontario potatoes, representing varieties resistant and susceptible to precooking discoloration, were examined for phenolic content, and for cytochrome oxidase and polyphenol oxidase activity by oxygen uptake measurements. Studies were conducted for 2 consecutive years, 1956 and 1957, on potatoes harvested at different stages of maturity. Determinations were made at the time of harvest and after storage at 40° F. for different periods of time.

The phenolic content was determined by the method of Rosenblatt and Peluso. The phenolic content was higher in Ontario than in Pontiac potatoes and mature potatoes were slightly lower in phenolic content than immature potatoes. The change in phenolic content with storage was not consistent, but generally there was an increase in phenolic content during the first four weeks of storage.

Cytochrome oxidase activity was higher in the Ontario than the Pontiac variety. The effect of potato maturity on cytochrome oxidase activity was not consistent for the 2 years, for in the 1956 harvests a decrease in activity occurred with increasing maturity, but this maturity effect was not noted in the 1957 harvests. There was no consistent trend in cytochrome oxidase activity with time of storage of the potatoes.

Polyphenol oxidase activity increased with potato maturity in the 1957 harvests, but no consistent trend was noted for the 1956 harvests. In both years the activity decreased sharply after one month of storage and then slowly increased through 6 months of storage. Higher enzyme activity was found in the Ontario than in the Pontiac variety.

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CONTROL OF EXUDATION IN PREPEELED FRENCH-FRY POTATOES WITH ANTIBIOTICS

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Prepeeled potatoes in conventional containers will exude liquid which collects in the bottom of the container providing an unsightly and unsanitary appearance. The potatoes are wet when they come from the dipping tank and normal healthy potato tissue absorbs the excess moisture within a few hours. After a lag period while the microbiological flora are building up, the potatoes start to exude liquid and the rate of exudation increases rapidly. Oxytetracycline, and chlortetracycline in the concentration of 5 to 10 p.p.m. in the dipping tank will minimize the accumulation of exudation. This results in firmer potatoes as the tissues become soft as the cells lose turgor. Severe chemical treatment will also increase the exudation and promote the production of alcohol in the tissues. Both alcohol production and exudation are related to the degree of chemical injury and anaerobiosis, and the antibiotic serves as a protection against microbiological invasion of the weakened tissues.

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BROWNING OF POTATO CHIPS. I. EFFECT OF TOTAL SOLIDS ON COLOR INTENSITY

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The role of total solids content in browning of potato chips was investigated in model systems. Two basic types of model systems were developed: one using starch to represent the solids content, the other using filter paper as the solid matrix. Glucose and glycine in various concentrations were the sources of browning reactants.

Results obtained on filter paper depend on the method of preparation of the model system. To show the effect of total solids on color intensity in model systems, methods of preparation must duplicate the conditions in potato chipping. Color intensity produced by the browning reaction was directly proportional to total solids content in the model system. Doubling solids content had the same effect as halving the concentration of browning reactants. Conversely, halving solids content gave the effect of doubled reactant concentration.

To compare color intensities produced in model systems and in potato chips, absolute amounts in milligrams of browning reactants per gram of solids instead of solution concentrations must be considered. Using this concept the maximum theoretical intensities obtainable by certain fractions of browning precursors found in potatoes were studied.

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EXTENDING THE SHELF LIFE OF CREAMED COTTAGE CHEESE BY MEANS OF SORBIC ACID

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The incorporation of sorbic acid or sorbic acid salts into creamed cottage cheese improved its keeping quality. The efficacy of the preservers depended on the employed concentrations, the temperature of incubation and the intensity of the initial contamination of experimental samples. Neither sorbic acid nor its salts appreciably improved the keeping quality of heavily contaminated samples but they did markedly suppress spoilage microorganisms normally present in small numbers in creamed cottage cheese. Consequently these additives should be regarded not as substitutes for but rather in addition to best sanitary practices.

The observed suppression of growth refers to yeasts and molds as well as to bacteria. The former group was found to cause the most conspicuous spoilage in the experimental as well as in commercially available samples. The predominant growth of these contaminants was of a surface character. Bacterial growth on the other hand occurred throughout the experimental samples.

The intensity of the bacteriostatic activity of sorbic acid and its salts was more pronounced at the lowest incubation temperature employed. The reported experiments were limited to creamed cottage cheese manufactured in a dairy plant. The relative value of sorbic acid, potassium sorbate and calcium sorbate as preservers is discussed. Studies on deliberately inoculated and non-inoculated experimental samples were conducted at 50° F., 45° F. and 35° F. The yeasts and molds employed were isolated from a spoiled sample of commercial creamed cottage cheese. Separate microbiological examinations were conducted on surface and interior portions of non-inoculated samples.

Bacterial growth was evaluated by means of formate ricinoleate broth and peptone beef agar. The latter was employed to provide a simple and reliable medium for differentiating contaminants contributing to spoilage from the lactic acid group normally present in creamed cottage cheese.

No evidence was found indicating that sorbic acid tolerant microorganisms grew at the expense of suppressed sorbic acid sensitive microorganisms. No decrease in sorbic acid content was found during storage after 4 weeks at 45° F. Flavorwise, the samples containing the added preservers up to 0.07% concentration by weight were similar to control samples.

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THE VARIABLE TASTE PERCEPTION OF SODIUM BENZOATE

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Two hypotheses as to the source of variability in the taste perception of sodium benzoate were tested: (a) that the observed variability is due to differences among people in the typical single quality which each person perceives, and, (b) that the observed variability is due to differences in concentration of the sodium benzoate.

Five solutions ranging from near threshold to moderately strong were tested, with replication, by trained panel members, who rated the intensity of salt, sweet, sour, and bitter for each solution. A large amount of variability was found; however, with few exceptions, panel members reported a mixture of qualities rather than a single quality. Analysis of variance showed significant differences among individuals in the qualities reported, but about equally important differences were associated with concentration. It is concluded that people cannot be reliably classified on the basis of their responses to sodium benzoate.

79
CHANGE IN VOLATILE CONSTITUENTS DURING THE SHERRY BAKING PROCESS

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The changes occurring in the volatile carbonyl, ester, and acidic constituents of sherry wine were followed throughout the Tressler baking process. The wines employed in this investigation were prepared from Concord and Niagara grapes and baked in a commercial winery. Samples were taken at intervals during the process and analyzed for the volatile components, (esters, carbonyl, and acidic compounds).

During baking, all 3 groups of compounds increased, but the rate of development differed. The Concord sherry wine showed the most noticeable change from its initial analysis. The carbonyl and acidic components increased at a rapid rate, while the ester increase was slight. The Niagara sherry wine showed the greatest increase in the carbonyl groups, while the increase in acidic components was slight. The increase of the volatiles in the Niagara sherry was approximately one-half that of the Concord. After 8 months of storage, no appreciable change in the volatile constituents was noted.

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A CONTINUOUS PROCESS FOR DEHYDRATING HONEY

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The production of a high-quality dried honey could increase the consumption of this commodity, both by expanding its use in existing outlets and by making possible additional new uses.

A continuous dehydration process has been worked out successfully on a pilot plant scale which produces dried honey having excellent color and flavor and a free-flowing granular physical form. Dry honey from a number of different floral sources has been produced, both in pure form, as well as containing various proportions of added sucrose. When held in sealed containers, preferably with an inpackaged desiccant, the product will keep indefinitely at temperatures up to 90 or 100° F. To forestall caking at the higher temperatures, the presence of added sucrose is necessary.

In conjunction with the production of the dried honey, honey "essence" or concentrated aroma of about 100-fold strength has been made, and could have application as a honey flavoring agent.

Commercial outlets envisioned for the dried honey include its use by commercial and retail bakeries. Also, it could easily be incorporated into packaged dry baking mixes for household use. Another outlet is in confectionery.

Preliminary small-scale baking tests with the honey have been carried out. Costs for a proposed commercial-scale plant also have been estimated.

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EFFECT OF METALLIC IRON ON THE SPOILAGE OF CANNED PORK LUNCHEON MEAT

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Commercially canned pork luncheon meat, taken from refrigerated storage, removed from the original can, ground, and then repacked under vacuum in small tins in our laboratory, sometimes spoils during a few months incubation at 85° F. The tins containing spoiled meat often show patches of bare steel. This observation led to tests of the effect of added iron powder on the spoilage of canned pork luncheon meat.

It was found that when pork luncheon meat was ground in our laboratory, mixed with iron powder and then vacuum-packed in small tin cans, the tins swelled within one week when incubated at 85° F. Similarly packed pork luncheon meat, containing added iron and *Clostridium botulinum* spores, also spoiled in the same fashion. No botulinus toxin was found in meat taken from the inoculated or the uninoculated cans that had spoiled under these conditions. Microscopic examination, and other bacteriological tests, indicated that a culture of Gram positive cocci was present in every instance. Similiar cocci were also isolated from the original pork luncheon meat before it was repacked in our laboratory.

In another series of experiments, ground pork luncheon meat was mixed with iron powder, packed into small tins, sterilized in an autoclave, inoculated with *C. botulinum* spores and incubated at 85° F. These cans of meat spoiled in 2 to 4 weeks; they contained large amounts of botulinus toxin, as well as *C. botulinum* cultures.

These data indicate the following: 1) the admixture of metallic iron powder hastened the spoilage of canned pork luncheon meat, 2) even when inoculated with *C. botulinum* spores, swollen cans of pork lunchon meat did not contain botulinus toxin when the cans were incubated at 85° F. The gas developed by the cocci that did grow was a safety factor in this situation.

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CURING OF HAM: A STUDY OF SODIUM CHLORIDE ACCUMULATION. II. COMBINED EFFECTS OF TIME, SOLUTION CONCENTRATION AND SOLUTION VOLUME

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Diffusion of sodium chloride from solution into isolated pork thigh muscles was studied. The amount of salt diffused into the muscle through one centimeter square of area exposed to solution was called accumulation value.

Accumulation value increases linearly with concentration of the salt solution. Logarithm of accumulation value increases linearly with logarithm of time. Slope of the logarithm accumulation value-logarithm time relationship is independent of solution concentration.

There is a direct linear relationship between accumulation value and solution volume. Slope of this relationship increases with volume.

The effects of time, solution volume and solution concentration on accumulation value may be expressed by the following empirical equation:

$$\log A = 0.42 \log t + \log c + \log (1.7 v + 40.2) - 2.58$$

Where: A—is accumulation value in mg./cm.^{2}
t —is time in hours
c —is solution concentration in g./l.
v—is solution volume in ml. per cm.^{2} of muscles area.

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PATTERNS OF REDNESS LOSS AND REGENERATION IN PREPACKAGED BEEF

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Discoloration is a serious problem in prepackaged self-service meat. It prevents centralized prepackaging which would be desirable for the meat industry. Within 48 hours, meat, as now packaged in coated cellophane, discolors seriously.

It was found that vacuum packaged beef exhibits a return in redness after an initial period of discoloration. The return red color is not the same as the initial bright red "bloom" of meat but is felt to be adequate red color for fresh meat.

The results of a detailed study of this phenomenom are reported. Beef was vacuum packaged and air packaged in various films, in small cans, and in aluminum foil-polyethylene. The effect of glucose oxidase treatment for removal of trace oxygen was investigated. An attempt was made to determine the effect of initial "bloom" redness of beef on subsequent color history.

It is concluded that the pattern of color change in storage of fresh beef from a given source is essentially the same for any given set of packaging conditions. There is, however, consider-

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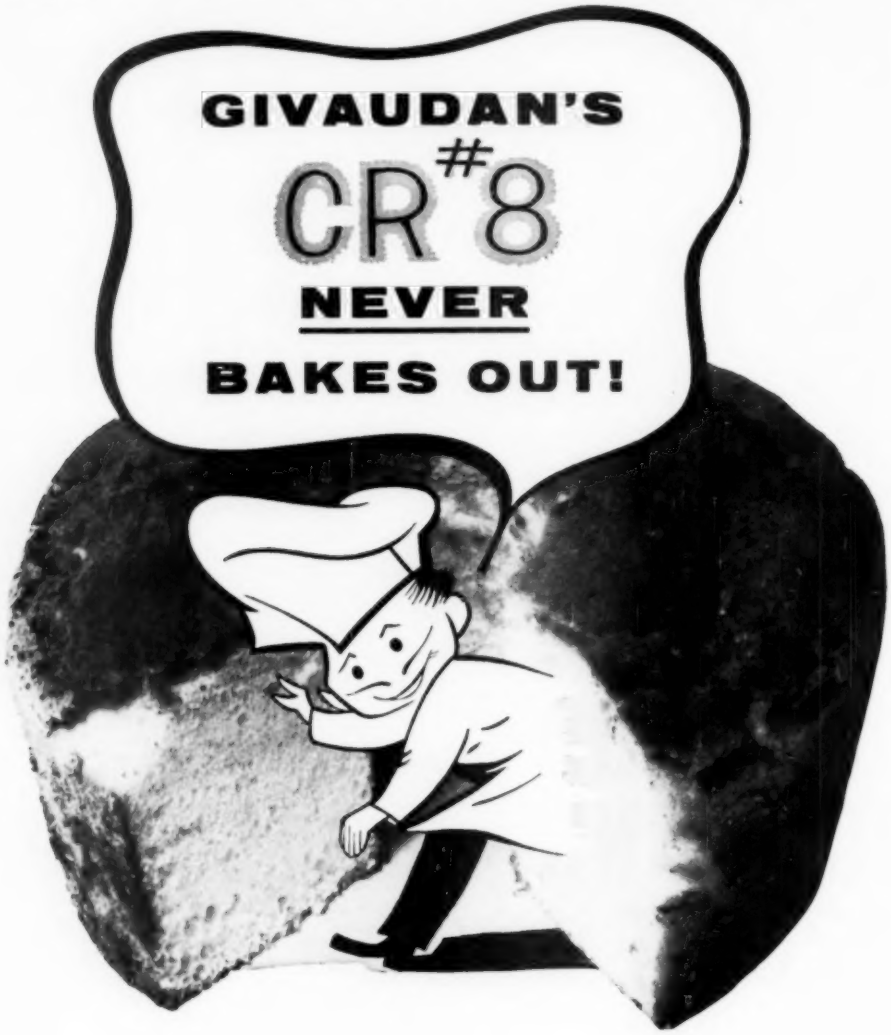

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able evidence that the inherent characteristics which differ in meat from different animals may be responsible for substantial difference in color history during storage.

In vacuum-tight containers, the red color which appears in meat a few days after packaging is stable for a period longer than the shelf life of the product. This makes centralized prepackaging feasible if packaging difficulties can be overcome.

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SOME FACTORS INFLUENCING COLOR UNIFORMITY AND STABILITY IN CURED HAMS

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Studies were made on processing and physiological factors which may influence uniformity and stability of color in fresh and cured hams. Artery pumping pressures in the range of 40 to 60 p.s.i.g. were found to be satisfactory and had little effect on cure penetration and uniformity of color in hams. The use of high levels of sodium ascorbate to the curing pickle did not significantly affect color uniformity or stability in hams.

When hogs were stressed by either 15 min. "forced exercise" or by ante-mortem adrenalin injections above 3 mg. per 100 lb. live wt. 14 hrs. prior to slaughter, color uniformity of the resulting hams was improved. The color of these cured hams was stabilized for as long as 6 days when high concentrations of sodium ascorbate were added to the curing pickle.

In an examination of 260 fresh ham muscles, it was observed that the pH values of the controls were about the same as for the muscles obtained from hogs injected with 3 mg. adrenalin ante-mortem. When higher levels of adrenalin were injected, the resulting fresh ham muscles were increasingly darker, more uniform, had a firmer structure and higher pH values than the controls. Color uniformity of the cured hams became less desirable with the higher levels of adrenalin injections.

The shackling of 92 hogs during slaughter operations had no significant effect on color uniformity in ham muscles.

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IMPROVING THE STABILITY AND ACCEPTABILITY OF PRECOOKED FREEZE-DRIED HAM

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The principal factors affecting the acceptability of precooked freeze-dried ham are color and flavor. Adverse changes in these attributes occur during short-time storage of the product. It was hypothesized that the curing ingredients of commercially cured hams were responsible for these changes. Accordingly, experiments were designed in which (1) curing methods, (2) alteration or substitution of curing ingredients, (3) time and temperature of curing and (4) pre-cooking conditions were modified in an attempt to increase the storage stability. The results failed to show increased stability beyond that which may be obtained with commercially cured hams.

Various stabilizers were incorporated in precooked ham samples prior to or during freeze drying. Changes in the color and development of rancidity were followed by appropriate methods during accelerated storage tests. The results indicate little, if any, beneficial effects as a result of these pre-treatments.

Flavor panel results indicate that vacuum packed, commercially cured, precooked freeze-dried ham retains its acceptability for 5½ months when stored at 70° or 100° F. When packaged with carbon dioxide or nitrogen, adverse changes in the color and flavor at the 5 month storage period resulted in an unacceptable product.

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VARIATION IN THE QUALITY OF RAW AND COOKED PORK

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Many interrelated factors are involved in the problem of judging the quality of meat. The consumer considers the appearance and grade of the meat in addition to its cost, and relation of these to the quality of the cooked product needs to be evaluated.

In a comprehensive study on the quality of pork from meat-type and fat-type hogs, many problems arose as to which muscles and which criteria to use that would best indicate quality of the meat. This paper presents results of measurements of color, marbling, size and tenderness of muscles from raw and cooked fresh pork in addition to panel evaluations and fat and moisture determinations. The *Semimembranosus, Semitendinosus, Adductor, Biceps femoris,* and *Rectur femoris* muscles of the ham (leg) and the rib and loin ends of the *longissimus dorsi* muscle of the loin were used for the measurements. The relation of physical and chemical measurements to panel evaluations of meat quality and the variations among and within muscles are discussed.

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EFFECTS OF pH AND IONIC STRENGTH ON THE EXTRACTABILITY OF BOVINE MUSCLES

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A study has been made of the release of nitrogenous compounds (primarily proteins) from two bovine muscles, *Semimembranosus* and *Serratus ventralis*. At 4° C., a finely ground meat sample (10 g.) was suspended overnight in 20 ml. of extractant liquid. The pH of the system was varied by the presence of HCl or KOH in the liquid, and the ionic strength was adjusted by the addition of KCl as needed. After centrifugation (30,000 x g., 30 min., 4° C.) the change in weight of the meat residue was determined, and the supernatant fluid was analyzed for pH, non-protein nitrogen (i.e., soluble in 5% TCA) and total nitrogen content, pigment, ATP-ase activity, and other related properties.

Extraction of non-protein nitrogenous compounds was only slightly pH-dependent and was substantially independent of ionic strength. Protein nitrogen and pigment in the extracts were considerably influenced by both pH and ionic strength. The weight of the meat residue increased with the total release of protein nitrogen, but followed the trend of pigment extraction only over a limited pH range.

A further investigation has been made of the variation in extractability due to extract volume. Also, the effects of repeated extractions, and of extractions of the same sample at two different conditions of pH and/or ionic strength have been measured.

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FACTORS AFFECTING THE WATER RETENTION OF BEEF. II. VARIATIONS IN SOME pH DETERMINANTS AMONG EIGHT MUSCLES

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Investigation of factors associated with variation of the pH of muscles was emphasized to obtain further knowledge of properties related to the water retention, juiciness, and tenderness of meat. Data were obtained on the pH, buffering capacity, and content of glycogen, lactic acid, water soluble and non-protein nitrogen, and soluble non-dialyzable zinc compounds of a series of muscles. These muscles were the *Longissimus dorsi, Psoas major, Semimembranosus, Serratus ventralis, Rectus abdominus, Semitendinosus, Latissimus dorsi,* and *Trapezius*.

Lactic acid content was directly related to pH as has been previously reported. The extractability of glycogen with trichloracetic acid approached that with alkali when extraction with the former reagent was accomplished in a blender. Inasmuch as extractability with trichloracetic acid varied with comminution, differentiation of free and fixed glycogen because of differences in solubility in these reagents appeared arbitrary. The glycogen content of the muscles varied directly with protein content. Differences in the buffering capacity of fresh, post rigor, and aged muscles were determined. Buffering capacity was directly correlated with muscle protein content. Buffering capacity varied inversely with muscle pH, indicating that buffering modified, but was not principally responsible for, differences in the ultimate pH of the muscles. Data obtained on the content of water soluble and trichloracetic acid soluble nitrogenous fractions and the content of soluble non-dialyzable zinc compounds are discussed in relation to the ultimate pH of the series of muscles.

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EFFICACY OF OXYTETRACYCLINE FOR AGING BEEF

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Beef aged at elevated temperatures has a tendency to develop microbial growth on the surface along with deep seated spoilage and bone sour of the round. The utility of oxytetracycline (OTC) to control this spoilage was investigated.

Twenty-seven Standard and Utility cattle were injected intramuscularly with OTC at the rate of 0.60 and 0.80 mg. per lb. of body weight 30 minutes to 6 hours antemortem. At the time of slaughter, samples of blood, heart, liver, kidney, spleen and muscle were taken from each animal for bioassay. The concentration of OTC in these tissues was affected by time lapse between injection and slaughter. The concentration in the blood decreased with time while the concentration in other tissues, except spleen, increased up to 4 hours and then decreased. No OTC was found in the splenetic tissue.

After slaughter, the right side of each carcass was placed directly into an 86° F. aging room without chilling and held 48 hours under controlled environmental conditions. The left side was held 15 days (control) at 36° F. Muscle samples were removed for microbiological assay from the short loin every 24 hours during the aging period. Assays conducted on raw samples and steaks broiled to medium rare and medium well done revealed a substantial reduction in OTC concentration of the medium rare steaks with no detectable residual found in the medium well done steaks.

Total numbers of organisms on the surface of the product and of the synovial fluid increased during the high temperature aging period. Samples of the popliteal lymph node and semimembranosus taken at the end of the respective aging periods resulted in a higher total bacteriological count from the beef aged at 86° F. as compared to 36° F.

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MEAT FLAVOR STUDIES. I. THE FRACTIONATION OF THE NON-VOLATILE FLAVOR OF BEEF

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The study of meat flavor, and the chemical components which comprise flavor, is of interest to the Armed Forces in the improvement of rations which depend heavily upon dehydrated items. Beef, the largest meat item procured by the services, was naturally chosen as the first subject item for flavor investigation. Experimentation showed that a water soluble, dialyzable fraction of boiled beef was closely akin to the flavor of fresh cooked beef. This fraction, after concentration *in vacuo*, was utilized throughout the studies as beef flavor concentrate. Paper chromatography of the flavor concentrate revealed the presence of many organic functional groups. As an aid to their separation and identification further fractionation of the flavor compounds was deemed necessary. This paper reveals studies on the fractionation of the flavor concentrate in an effort to obtain functional group specificity of fractions. Discussed are solvent extraction, adsorption, ion exchange, and electrophoretic procedures. Adsorption procedures using various deactivated charcoals have showed most success in group selectivity while electrophoresis shows greatest selectivity in separating individual compounds.

The contribution of the fractions to the flavor of beef will be discussed.

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MEAT FLAVOR STUDIES. II. IDENTIFICATION OF NINHYDRIN POSITIVE COMPOUNDS FROM BEEF FLAVOR CONCENTRATES

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Ninhydrin positive reacting compounds are the largest group of organic compounds present in beef flavor concentrate. According to the method of preparation of the concentrate, this material should contain the amino acids, amines, low molecular weight peptides, and other compounds with a free or mono-substituted amine group. The separation of these compounds and their identification qualitatively and quantitatively will be discussed. Also, their apparent role as contributing factors to beef flavor will be discussed.

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METHODS FOR EVALUATING FREEZE-DRIED BEEF

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Taste panel ratings of freeze-dried beef do not differ significantly from those obtained for fresh meat. This suggests that the changes which result from the drying process are presumably not extensive. Conventionally, freeze-dried meat is prepared by drying over a period of at least 24 hours at a plate temperature of about 40° C. The drying time has been reduced, however, by recent techniques which employ higher plate temperatures. Freeze-dried beef prepared by the Accelerated Freeze-Drying process, in which contact plates are used, is reported to lose 50% of its adenosine triphosphatase (ATPase) activity, and much of the contractility.

This paper presents 4 criteria for determining the changes produced by dehydration, viz., extractable nitrogen, viscosity of the extracts, electrophoretic mobility of the protein components, and ATPase activity. Using these criteria, ground beef freeze-dried conventionally, (30 hour cycle, plate temperature 37° C.), shows no significant change from frozen meat. The effect of other dehydration techniques is also discussed.

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DESIGN OF FREEZE-DRYING EQUIPMENT FOR THE DEHYDRATION OF FOODSTUFFS

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Although there is considerable interest in the process, no equipment designed specifically for freeze-drying food on a large scale is available. For such equipment the following characteristics are of importance: simplicity of construction; quick loading; prevention of thawing during loading and pump down; ability to run without supervision and adjustments; ability to dry a variety of products of various shapes and textures; reasonably rapid drying; uniformly heavy loading of the vacuum chambers to make maximum use of pumping capacity.

A method of achieving these is by the use of chambers fitted with blackened shelves, electrically heated and movable so that the number of shelves and the space between them may be varied as desired. The material to be dried is laid on trays or between aluminum plates or, for layers thicker than ½ inch, between plates fitted with aluminum spikes, and then frozen. For drying, the trays or plates are loaded between the heating shelves leaving a small gap of ¼ to ½ inch at the top and bottom. Thermostatically controlled radiant heat from the shelves provides efficient heat transfer for drying cycles of from four to seven hours.

Evacuation of the system may be by steam ejector or by mechanical pump plus ice condenser, depending on the facilities available.

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FOULING OF EVAPORATOR TUBES BY TOMATO

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A serious problem in the production of tomato products is the fouling of the heat transfer surfaces. The composition and treatment of the fruit before evaporation plays a major role in the rate of fouling for any particular conditions of operation. The roles of various components have been studied by making up feeds synthetically from basic materials. These synthetics have been compared at several rates of evaporation in a model flash evaporator. The fouling by the complete synthetic mixture has been compared with fouling by tomato juice. Results show the importance of fiber size and concentration, pectin quality, and protein concentration.

95

LONGITUDINAL TEMPERATURE DISTRIBUTION IN A SCRAPED-SURFACE HEAT EXCHANGER

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For studies of the effects of HTST processing on the chemical and physical qualities of foods, a processing system, including the "Laboratory Votator Heat Exchanger," was constructed. A temperature measurement system which would easily and quickly determine the temperature distribution of any product processed was developed and evaluated.

Reported here is the study of flow rates, mutator speeds and temperature rises (including outlet temperatures of up to 300° F.), on the temperature profiles of water in the steam heated "Laboratory Votator Heater."

When the temperature profiles were compared with a theoretical logarithmic rise, assuming the jacket heads to be but half effective, the following conclusions were drawn: (1) An apparently-rapid reduction in the unaccomplished temperature rise, (steam temperature minus the product temperature, at any point), occurred in the entrance region of the exchanger; (2) The logarithm of the unaccomplished temperature rise was essentially linear with length. Further work is required, however, because two trends not creditable to experimental error alone, were observed: first, an accelerating rate of reduction of the unaccomplished temperature rise in the central portion; second, the then-decelerating rate of reduction of the unaccomplished temperature rise at low flow rates and moderate to high temperature rises. Probable causes for these phenomena—including this later "break" in the heating curve—are presented.

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HEAT TRANSFER IN HOT FAT COOKING

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The Smitherm method of hot fat cooking of food products is a process designed to overcome the inherent defects associated with the direct-fire method of heating the cooking fat. The process consists of a heat generator which is essentially a water tube boiler using forced circulation by means of a pump. The heater is fired by gas or oil and the liquid circulated through the heater is a high boiling, nonflammable, noncorrosive heat transfer material. The heat transfer liquid is circulated through the shell side of a shell-and-tube heat exchanger where it gives up its heat to the cooking fat. The fat is circulated through the tube side of the same heat exchanger.

The cooking fat is removed from one end of the cooking kettle by a special type centrifugal pump and is circulated through the tubes of the heat exchanger and introduced into the opposite end of the cooking kettle.

This process removes the fire hazard from the food processing area, reduces fuel cost, provides means for precision-temperature control, and most important of all, is far less damaging to the cooking fat than any process in which the hot products of combustion are in direct contact with the thin wall of the kettle. One heat generator can supply any number of cookers, each operating at a temperature suited for the products being processed.

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LYE—PRESSURE STEAM PEELING OF POTATOES AND OTHER PRODUCTS

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and
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This is a study of a very important unit operation in food preparation, that of peeling fruits and vegetables. A mechanical, lye or steam peeler each has its limitation as to applicability. Pre-coating products with hot caustic solution, followed by subjecting them to atmospheric steam or steam under pressure offer much greater flexibility in results and process control.

The report has special reference to commercial application of the process to Idaho potatoes, showing yield and trim labor savings, chemical cost, etc.

Application of the method to other products, such as apples, onions and other root crops, cereals, nuts, tomatoes and pimientoes is discussed.

98

FOOD ENGINEERING FOR ATOMIC SUBMARINES

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With the advent of the ballistic missile launched from submerged submarines, the submarine's role in international politics and future warfare has been increased. The success of this weapons system will depend, in part, on the submarine's capability of remaining in the ocean's depths for long periods of time, safe from enemy detection and destruction. Food, because of its effect on morale and human efficiency, is a decisive factor in this capability. Comprehensive food production studies were conducted with the objectives of improving plant layout, equipment, and work efficiency, while maintaining or improving food quality and submarine space utilization. Theoretical process flow charts were used to determine equipment design and time-flow studies of actual operations, to determine plant layout. These studies resulted in the design and construction of new equipment and a new pilot facility. To determine if the objectives had been attained, 5 teams of submarine cooks accomplished the same food production tasks in the old and new facility. A comparison of personnel total work time, idle time, blood pressure, pulse, as well as equipment work time, power consumption, and food acceptability, indicated the value of this type of comprehensive study to plant design and layout problems, and that the study objectives had been obtained.

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HOW THE FOOD TECHNOLOGIST HELPS THE PRODUCTION MAN

E. C. RITCHELL (Green Giant Co.)
M. S. BURNS (California Vegetable Concentrates)
E. L. MORIN (Seabrook Farms)
RICHARD RATH (Rath Packing Co.)
J. H. NAIR (Consultant)

Each speaker will present a discussion of production difficulties he has encountered in his particular area of food processing. He will draw on his own experience with the technical aspects of various problems and indicate how the food technologist can be helpful in their solution. Vegetable canning, vegetable dehydration, frozen foods (both precooked and commodity), and meat packing will be covered. Following the formal remarks there will be afforded ample time for panel discussion of questions raised by members of the audience.

100

THE FOOD ADDITIVE AMENDMENT OF 1958

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This talk will cover (a) the basic requirements and provisions of the Amendment, (b) the procedures that must be followed to secure authorization for the use of a food additive, and (c) some comments on the problems facing the food technologist in clearing substances under the Amendment.

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THE PROBLEM OF THE PACKAGE

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It is fortunate for both the food processor and the packaging manufacturer that considerable work applicable to current requirements for food packaging has been done. On the basis of extant data, we have available a variety of FDA approved packaging material. The experience so gained has proven invaluable in programming the job of determining the status of as yet unapproved packaging for food.

While the objectives of the Food Additives Amendment of 1958 are the same for food packaging as for food, they will, for the most part, be realized in a somewhat different fashion. The most direct route to establishing the safety of food packaging requires demonstration where possible that significant migration of packaging components into food does not occur. That is, the packaging does not contribute any additive to the food. The problem, therefore, is to simulate in the laboratory specific commercial applications of packaging materials and to analyze for

extractability of their components into food. Certain assumptions which make this approach feasible are discussed as are the complexities of the procedures and their relevance to safety evaluation of packaging.

Where the analytical approach fails to adequately demonstrate noncontamination of food, packaging components become unintentional food additives and their safety must be evaluated by toxicological procedure. Even though safety of a packaging material may be established according to accepted criteria, increased burden of process and quality control devolves upon the manufacturer to assure continuous compliance. The difficulties of the food processor in securing packaging of an assured food grade are explored.

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FLAVORING AGENTS AS FOOD ADDITIVES

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Flavor additives account for more than half the total number of food additives now in use. In addition, they present unusual problems under the new Food Additives Amendment. Among these are the problems of usage at levels of practical insignificance, of developing analytical methods of great sensitivity and discrimination, and the value of the self-limiting characteristics as a factor in safety under conditions of actual use. Advancing technology and the Food Additives Amendment are bringing about a far reaching review of our knowledge and use of flavor additives.

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FOOD ADDITIVES: FOOD PROTECTION COMMITTEE ACTIVITIES

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The Food Protection Committee, a committee of the Food and Nutrition Board of the National Academy of Sciences—National Research Council, was formed in 1950. Its primary function is that of an advisory body for industry and public agencies on public health aspects of the use of food additives. Its activities have included: 1) critical evaluation of information pertaining to individual additives or classes of additives; 2) compilation of information; 3) development of general principles as guides to safe use of additives. Present activities of the Committee continue along these lines. Specific activities are discussed. Projected program of the Committee is also considered.

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SOME PRESSING PROBLEMS UNDER THE FOOD ADDITIVES AMENDMENT OF 1958

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The enactment of Public Law 85-849 and the adoption of regulations thereunder have brought into focus many responsibilities of industry for insuring the safety of food additives under conditions of use. Questions like how to establish general recognition of qualified experts, how to evaluate experience in common use, what constitutes appropriate safety factors and whether one can generalize in these respects, confront those responsible for administering the new law as well as those regulated by it. Various aspects of these problems will be discussed.

105

EFFECTS OF pH ON THE WATER-HOLDING CAPACITY OF MEAT AS DETERMINED BY THREE DIFFERENT METHODS FOR WATER-HOLDING DETERMINATION

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Normally chilled and ground meat (beef and pork) was mixed with standard NaOH or HCl solutions in the amounts from 0 to 25 milliequivalents per 100 g. tissue. The control samples contained 10% added water. The meat mixtures, ranging in pH from 2.5 to 12.5 were then investigated for their water-holding capacity in the fresh state [*J. Agr. Food Chem.* 6, 387 (1958)] and after heat denaturation [*Food Technol.* 11, 69 (1957)], along with the swelling determination with an excess of water by a method developed by the authors.

Additions of NaOH shifted the pH of the original meat to the alkaline side to a greater extent than equivalent additions of HCl reflected on the acid side. The water-holding capacity, swelling, and the shrinkage of the meat decreased with decreasing of the normal pH of the meat until a minimum pH of 5.0 to 5.4 was obtained, thus indicating the pH zone of the isoelectric point of muscle proteins. Further decreasing or increasing of the meat pH on both sides of this isoelectric zone gradually increased the water-holding capacity and swelling ability of the meat; the increase being greater per unit pH shift on the acid side.

Shift in pH effected a greater change in meat swelling than in water holding capacity of native fresh meat. The water-holding capacity of cooked meat was affected least, thus indicating that the heat denaturation of muscle proteins destroys a major portion of the water-holding forces, resulting from the addition of hydrogen or hydroxyl ions to meat.

The water-holding capacity and swelling of meat within the normal pH range from 5.4 to 6.9 were found directly related to the meat pH. Therefore these variables can be examined statistically.

Over 200 meat samples (beef and pork) were investigated for the water-holding capacity and meat shrinkage versus pH. The results will be discussed in the light of the theory of protein hydration with emphasis on the pH factor.

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HEAT RESISTANCE AND GROWTH CHARACTERISTICS OF MICRO-ORGANISMS ISOLATED FROM NON-STERILE CANNED HAMS

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A study has been made of the natural bacterial flora of non-sterile canned hams. Heat resistance data indicate that members of the Streptococcus group are the only surviving vegetative cells in this product after processing to the minimum internal temperature of 150 degrees F. required by the MID. Calculation of our processes by the graphical and mathematical methods indicates that we are processing to an F_o (minutes at 150 degrees F.) of 30–50. Data will be presented to show that Streptococcus cells in canned hams can survive this process.

Spores present in the hams are largely bacilli type spores that are not killed until a process of $F_o = 0.6$ (minutes at 250 degrees F.) is reached. Anaerobic spores of the putrefactive anaerobe 3679 type are present in the ham and additional heating ($F_o = 1–5$) is needed to destroy PA spores. Anaerobic spores contaminating the ham, when present, are extremely low in numbers (1–100/gram) and our work indicates that these spores behave differently than a similar number of spores grown in laboratory media and inoculated into the ham. The small number of spores remaining in the meat evidently are left from a large population of spores that have germinated.

Data will be presented on total counts, pasteurized counts, salt content, heat resistance values, temperature requirements for growth and the relationship between the various types of micro-organisms left after processing.

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THE EFFECT OF SUGAR ON THE FLAVOR AND COLOR OF SMOKED HAMS

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Sugar has been employed in the curing of hams for one or more reasons. The most common among these are: (a) the enhancement or development of flavor, (b) aid in the development and protection of the cured meat color, and (c) possible retardation of a putrefactive type of spoilage. The purpose of this research was to evaluate these factors in smoked hams produced under conditions used in industry today.

Taste panel data on 64 pairs of hams indicated that the threshold level of sweetness in hams cured 3–7 days was between 0.50 and 0.75% sucrose. This is higher than the concentration usually obtained in commercial practice.

Spectrophotometric analysis of acetone extracts of samples from the same hams indicated no effect of sugar upon the production of the cured meat color. In all cases (hams cured with

and without sugar) there was a significant fading of the cured color upon refrigerated exposure to light. However, there was no significant effect of sugar upon the rate of color fading.

Examination of ham samples wrapped in cellophane and vacuum packages and stored at 40–45° F. for 10 days revealed no putrefactive odor in any of the packages. Total plate counts on selected packages of both types revealed large numbers of bacteria which were primarily of the lactobacillus type. No differences attributable to sugar treatment were observed.

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FACTORS AFFECTING THE EFFICIENCY OF ANTIBIOTIC DIPS FOR FRESH FISH FILLETS

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The effectiveness of antibiotic dips in retarding the spoilage of fish is well recognized. However, there is little published data as to the effect of continued processing through a single dipping solution upon the subsequent shelf life of the treated fillets. The experiments described in the present communication were designed to provide information on this point.

Cod fillets were dipped in solutions with and without antibiotics (20 p.p.m. oxytetracycline or 20 p.p.m. chlortetracycline). The rate of dipping was comparable to commercial production of 1500 lb./hour through 30 gallons of solution. The processing lasted for 3 hours. Fillets were withdrawn at intervals during this period, packaged in polyethylene bags, and stored in ice. The subsequent spoilage of the fillets was measured by organoleptic observation, and by trimethylamine, total volatile base, and total volatile acid determinations.

As compared to the controls, the antibiotics demonstrated the expected preservative action and the same spoilage pattern was observed for all fillets from the various treatments. However, the rates of spoilage were related to the amount of fish processed. Thus, antibiotic-treated fish sampled after 15 minutes of production (equivalent to 375 lb.) showed 3 to 4 days longer shelf life than fish sampled after 3 hours production (4,500 lb.). This effect was essentially the same for fish dipped in either antibiotic solution.

During the first two weeks of storage at 32° F., there was no difference in the spoilage rates of comparable fillets dipped in either OTC or CTC. During the third week of storage, the rates diverged and OTC treated samples were considered unacceptable 2 days prior to the CTC treated samples.

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VARIATIONS IN THE CHEMICAL COMPOSITION OF HALIBUT FLESH

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Composition data quoted in nutritional tables are frequently misleading since they are often based on a very limited sampling. This situation is apparent in the data quoted for halibut which indicate that the percentage for oil is more than 5, and for protein less than 19. Actually the white meat of halibut seldom exceeds one per cent for oil, nor is less than 20 per cent for protein.

During the past two years the variations in chemical composition of halibut flesh have been thoroughly investigated. Analyses included from 10 to 20 samples taken from each of 40 fish ranging in weight from 1 to 50 kg. The specimens included both iced and frozen fish captured in the area from Vancouver to Kodiak Islands, and were obtained direct from the fishing vessels. Samples were removed from the right and left sides of cheeks, dark meat, belly flaps, fletch tips, fin flesh, and five steak sections from nape to tail.

Percentage variations in composition are as follows: moisture 61 to 82, oil 0.3 to 43, protein 13 to 23, ash 0.8 to 1.5, and in mg./100 g. for sodium 29 to 178, and for potassium 225 to 513. However, the great variations observed were found primarily in those parts ordinarily removed before the commercial steak cuttings are made. Composition ranges for the light meat, which represents the majority of the individual samples served, are as follows: moisture 78 ± 3%, oil 0.7 ± 0.4%, protein 21 ± 2%, ash 1.35 ± 0.2%, sodium 60 ± 30 mg./100 g., and potassium 425 ± 75 mg./100 g.

Thus, contrary to most published data, halibut flesh is low in oil, high in protein, and low in sodium. Since the fish are not brine refrigerated, nor the steak cuttings brine dipped before freezing, halibut steaks offer an excellent source of food for even the most restricted diets.

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THERMAL AND NON-THERMAL DEGRADATION OF CHLORTETRACYCLINE IN FISH AND SOME SHELLFISH

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Acronize chlortetracycline is known to be effective in prolonging the freshness of many foods. The question of a degradation of the antibiotic by several methods of processing prior to consumption was studied to note the effects of such methods on the chlortetracycline. A number of seafoods including some fresh water fish, were treated with chlortetracycline to impart various amounts of antibiotic to their flesh. Both lean and fatty fish and their respective products were subjected to various methods of cooking. Microbiological assays revealed the amount of chlortetracycline degraded. Pink salmon, tuna, sardines and haddock were treated with the antibiotic, canned and sampled during the retorting period to observe the antibiotic loss. No chlortetracycline could be detected after 50% of the full retorting time. Herring were pickled; sablefish and salmon were "hot" and "cold" smoked after treatment. Assay of samples withdrawn at various stages of these processes showed the remaining antibiotic activity to be virtually nil.

A few shellfish—scallops, oysters, and shrimp—were also treated and cooked. Shrimp were boiled while oysters were boiled, fried, or stewed. Antibiotic-treated scallop meats in addition to being cooked fresh were battered, breaded, partially cooked and then frozen before final cooking.

For average cooking conditions and normal pickling and smoking procedures, practically no chlortetracycline is found if the antibiotic is employed at the recommended levels.

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PENETRATION OF TETRACYCLINE ANTIBIOTICS INTO TUNA AND SOLE FLESH AND THEIR STABILITY DURING STEAMING AND RETORTING

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The purpose of the study was to obtain information showing the extent of penetration of the tetracycline antibiotics into tuna and sole flesh during immersion in brines and to determine the residues left in the flesh, particularly of tuna, after retorting. In sole fillets the maximum penetration occurred within about 5 minutes at different concentration levels. The penetration into tuna flesh of whole round fish varied with the concentration of antibiotic and with the depth below the skin. The skin and outside surface of the flesh were effective barriers to the entry of the antibiotics into the deeper layers of the fish. Steaming rapidly inactivated the antibiotics, with OTC being somewhat more heat stable than CTC. No active residues were found in the flesh after retorting. Possible implications of the results with respect to their practical use will be mentioned.

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QUALITY CONTROL OF POTATO FLAKE PRODUCTION

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Potato flakes are an improved form of dehydrated mashed potato recently developed by the United States Department of Agriculture. The process is basically a simple dehydration, in which a cooked and mashed potato prepared under carefully controlled conditions is dried on a single drum drier fitted with specially designed applicator rolls similar to those used in potato flour manufacture. The need for exact quality control methods became evident when the first commercial production using this process was begun late in 1957. This paper describes the development of these methods and their use in commercial operation.

Of utmost importance was the development of a standard procedure for judging the texture of the reconstituted product. Various rheological measurements were considered but did not prove

as successful as an organoleptic evaluation following a set standardized reconstitution procedure.

The Blue Value technique, originally developed for judging free starch content of potato granules, was thoroughly tested and modified to apply to a random sized potato flake. Experiments are described showing the application of this method to the reconstituted product as well.

Other factors of importance in the quality control program were the moisture level, screen size, sulphur dioxide content, visible defects, bacterial count, and net weight. The methods, frequency of testing, and the control procedures relating to these are discussed.

A graphic 24-hour chart showing the important variables was developed. Control limits shown for all variables assist the quality control personnel in guiding the plant operations.

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DERIVATION OF A NEW FORMULA FOR COMPUTING RAW TOMATO JUICE COLOR FROM OBJECTIVE COLOR MEASUREMENT

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The background of development and substantiating theory for the derivation of a new formula for computing raw tomato juice color is described.

Experinced personnel trained in tomato juice grading evaluated raw tomato juice samples using standardized Macbeth-Munsell disk colorimeters. Carefully prepared Munsell spinners having regularly spaced color attributes of hue, value and chroma in the regions of raw tomato juice colors were used for visual comparison. Arbitrary values from 10 to 30 in increments of 5 units were assigned the disks. Visual color scores could thus be given for juice samples by direct comparison match or interpolation.

Objective color measurements were made on all juice samples with a tristimulus photoelectric colorimeter in terms of C.I.E. trichromatic coefficients of X, Y, and Z and Hunter L, a_L and b_L. An abridged spectrophotometer was also used to characterize all samples in terms of spectral reflectance curves.

Numerous comparisons of visual scores with single dimension instrument measurements, ratios of two dimensions, and other established formulae, such as the a_L/b_L ratio and $\tan^{-1} a_L/b_L$ were made. However, highest correlation resulted between visual color scores and instrument measurements when all three color attributes of hue, lightness and saturation were appropriately accounted for.

Only when the positions of the juice samples in Hunter color space were visualized in relationship to the color scores did it become possible to derive an appropriate formula.

This new formula is expressed as

$$\frac{\cos\theta}{L} \text{ or } \frac{a_L}{\frac{(a_L^2 + b_L^2)^{1/2}}{L}}$$

where θ is the angle having a cotangent a_L/b_L, with L, a_L and b_L being the Hunter trichromatic coefficients. This formula correlated with visual score to the extent of 0.96 as compared with a correlation of 0.92 for lightness alone or the a_L/b_L ratio alone.

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PROCEDURES FOR DEVELOPING SCHEDULES OF PAYMENT FOR RAW MATERIALS ON A QUALITY BASIS

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A rational schedule of payment for raw materials may be calculated on the basis of the relationships of quality to: 1) yield in the field and in the plant, 2) costs of manufacturing and selling, and 3) estimated sales prices. When such data are fitted into a mathematical model, the seller or buyer may set up price schedules based on break-even returns at any given quality level. A *best* solution may also be advanced indicating the particular quality level at which both the supplier and the buyer may expect the greatest returns. The procedure is demonstrated for canned peas and corn, and frozen lima beans.

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SLURRY FLOW MEASUREMENT AS A METHOD TO DETERMINE THE QUALITY OF CERTAIN RAW, BLANCHED, AND CANNED VEGETABLES

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Maturity measurements of vegetable crops have been widely used by food processors for pre-testing, basis of payment, yard segregation, and quality control. In general these tests have measured the resistance to shear, compression, or puncture characteristics of crops. Processors being faced with increased emphasis on quality are in need of a low cost, precise, multi-product, quick method to determine quality of vegetables.

The proposed procedure measures the rheological properties of slurries of blended vegetable tissues and water. The flow of these slurries on a flat surface is directly related to the amount of alcohol insoluble solids in the mixture. The greater the A.I.S. the more limited the flow under standard conditions. Range of flow on an Adams Consistometer plate was 4 inches using lima beans and peas from high to low quality.

On lima beans and peas correlation coefficients of 0.90 or higher were obtained between the slurry flow, % A.I.S. canned product, tenderometer, and shear press. This test may also be adapted to black-eyed peas, corn, green beans, soak time on dried beans, sweet potatoes and others.

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A NEW METHOD FOR SCREENING FLAVOR PANEL MEMBERS AND ITS APPLICATION TO A TWO SAMPLE DIFFERENCE TEST

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A screening and test method have been developed which, when used in combination, allow subtle flavor differences to be detected in specific foods.

Tasters screened for sensitivity to low concentrations of bitterness and with precision in reproducing their judgments were found to have above average ability to detect flavors in beer. The Two Sample Difference test, when used in combination with this screening procedure offers a new method of "flavor analysis" in the detection of subtle differences.

A known sample of a bitter solution was submitted to the prospective taster. Later more dilute samples of the same solution, in order of increasing concentrations were presented. The level of sensitivity was determined where tasters were able to detect as well as identify the taste. This series was run in duplicate to verify prospective tasters precision and sensitivity. The tasters found to be the most precise and sensitive were then used as a panel for the Two Sample Difference test. A known standard sample was presented to the panel member along with a test sample. The taster was asked to determine whether or not a difference existed between the two samples. This degree of difference, if any, was recorded on a scale and submitted to statistical evaluation. Subsequent development of the method includes certain checks on taster performance.

Persons thus screened for sensitivity to specific flavor notes may be used to determine the relative amount of the flavor component affecting a difference between a test material and a standard sample. The method and areas in which it might be used are discussed.

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A STUDY OF A SPECTROPHOTOMETRIC METHOD FOR THE FLAVOR EVALUATION OF INSECTICIDE TREATED VEGETABLES

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Many of the new organic insecticides are responsible for flavor alteration in vegetables. Continued development of organic insecticides coupled with their expanded use has magnified the limitations of flavor panels for evaluating insecticide treated foods. This study was designed to develop an objective method of flavor evaluation to obtain results more accurate and reproducible than possible with a flavor panel. From a literature review it was concluded that flavor effects of insecticide treatments can be manifested in the lipid fraction of vegetables and might be characterized by absorption spectrophotometry.

Test vegetables were Chanteney carrots, Carmel Cross corn, and Purple Top White Globe turnips. Vegetables were grown on soils which were treated with chlorinated insecticides. Vegetable samples were evaluated by a trained flavor panel. Flavor data were analyzed by an analysis of variance to detect significant differences between insecticide treated and untreated samples.

Samples of vegetables were lyophilized. Condensates from the lyophilization step were collected. Lyophilized vegetables and condensates were extracted with various hydrocarbon solvents. Examinations of extracts in the visible, ultra-violet, and near-infrared regions were made with a Beckman DK-2 recording spectrophotometer. Special techniques were used to prepare carbon disulfide extracts for infrared examinations which were made with a Perkin-Elmer IR-21 spectrophotometer. Spectra of extracts were compared to see if samples with flavor differences had spectral differences.

Flavor differences in insecticide treated carrots, corn, and turnips were associated with differences in infrared absorption spectra of extracts of condensates. With the exception of ethyl alcohol extracts of untreated and BHC treated carrots and turnips, flavor differences in insecticide treated vegetables were not accompanied by spectral differences in extracts of lyophilized vegetables.

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FACTORS AFFECTING THE CONSISTENCY OF CATSUP

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Consistency of catsup is controlled by a complex system comprised of many variables, which can be modified by processing procedures. Fifty-eight pilot-plant samples were prepared to study the effect of variety and maturity, hot-break temperature, initial screen size, sugar level, added calcium, time of concentration, and finishing screen size on consistency. In addition to the above samples, 18 commercial samples were analyzed for the different forms of solids and pectins, intrinsic viscosity of extracted pectins, syneresis, and consistency by several methods.

The effect of processing procedures and the relationship between catsup components on consistency is discussed.

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INTRODUCTION AND BACKGROUND OF THE FOOD STANDARDS SYMPOSIUM

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Official definitions and standards of identity for foods are required under the Food, Drug and Cosmetic Act of 1938. Section 401 thereof provides that "Whenever in the judgment of the Secretary such action will promote honesty and fair dealing in the interest of consumers, he shall promulgate regulations fixing and establishing for any food, under its common or usual name so far as practicable, a reasonable definition and standard of identity, a reasonable standard of quality and/or reasonable standards of fill of container:—." In the twenty years under the Act more than 182 foods, including 61 kinds of cheese, 32 cereal flours and related products, 3 kinds of dressings for foods, and 86 other foods have been so defined. Today's program is to consider all principal views in agreement and those yet controversial. To this end, representatives of the consumer, academic research, industry research, food law practice, and official food regulatory fields will speak.

Definitions and standards of identity for foods have many widely approved features and functions. Still in contention, however, are the influence on new formulations research, the restrictions of even the minor-quantity optional ingredients, the slow and tedious revision of standards even with benefit of the Hale Amendment, the omission of required-ingredient labeling, and the involvement of the administrative agency into a field some regard as unreasonable official "recipe writing."

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WHAT INFORMED CONSUMERS EXPECT FROM FOOD STANDARDS

MARY B. WOOD
Cornell University
Ithaca, New York

Americans expect a great deal of their food supply, and they take much of what they expect for granted. By and large, we accept it as a matter of course that the foods we buy are sanitary; we have little concern about adulteration. And we expect the food industry to continue to supply us with a multitude of food products for everyone, for everyday use and for special use. This it does remarkably well—infant foods, dietetic foods, foods for special nationality and religious groups, foods for busy homemakers, foods for gourmets, foods for every taste—all are available.

Informed consumers know why food standards have evolved, and what they mean. They understand that the establishment of standards is a slow, complicated process. They know that the information on the label of food products indicates whether or not the foods are standardized. They are asking for additional standards for relatively new food products, provided such standards help to maintain quality and nutritive value. At the same time, they want these standards to permit individuality in products and they want this kind of protection to be provided as economically as possible.

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VIEWS OF A PROFESSOR OF FOOD TECHNOLOGY

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Objectives of research are development of new food products and processing techniques, adoption of new materials, lowering of costs, improvement of qualities, and preservation and extension of the world's food resources. Competition of foods for a place in the stomach at the moment, in this country, is real and important to local area processing industries, albeit thoughts of research may be toward feeding teeming masses to come. Local area operations must take advantage of every facet of technology to retain economic position, and much research must be so directed. A number of problems affect the emphasis and direction of much research. Among these are (a) the tremendous inconsistency in regulations and standards for foods in inter and intrastate trade (b) the numerous examples of inconsistencies in federal laws pertaining to foods (c) the unrealistic necessity of evidence certain agronomic chemicals be without flavor effect (d) the apparent widespread laxity of complete understanding or knowledge by users of carriers, ingredients and supplements in compounds used in processing foods (e) the need of standards of chemical as well as physical purity (bromatopoeia) of additives used in foods (f) the increasing numbers and magnitude of groups subject to restricted food regimes.

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AN INDUSTRY VIEW OF FEDERAL DEFINITIONS AND STANDARDS OF IDENTITY FOR FOODS

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A questionnaire was sent to more than 60 food companies, food trade association secretaries, and suppliers to the food industry, asking for their attitudes concerning such questions as to benefits or harm to either manufacturers or consumers arising from the administration of the standards provisions of the 1938 Food, Drug and Cosmetic Act. Has research been affected? Should additional foods be standardized? Should some standards be repealed?

No unanimity on any point was found except that changes in some past practices are desirable. But there was no agreement on what these changes should be.

The great majority seem to feel that standards have helped the consumer in many cases but they have deprived him of better products which he would have had in the absence of standards. Research on standardized products is discouraged.

A minority believe the consumer has greater confidence in foods that are known to be subject to standards, but even this group expresses the opinion that no further standards should be established unless there is a genuine and well authenticated need for them. A very few take the position that standards should be abolished entirely.

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ASCORBIC ACID AND CAROTENE CONTENT OF FROZEN BROCCOLI AS AFFECTED BY VARIOUS FACTORS

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Human Nutrition Research Division
Washington 25, D. C.

Significant losses of ascorbic acid occurred during cooking of frozen broccoli. Leaching of ascorbic acid into the cooking liquid rather than destruction by heat was found to be chiefly responsible for this loss. Retention of ascorbic acid in frozen broccoli cooked by micro-wave and conventional methods compared favorably with that in fresh broccoli cooked by the same methods. No significant losses in carotene content of broccoli were found.

Frozen broccoli contained less dehydroascorbic acid (5 to 9 mg./100 gm.) than did fresh broccoli (6 to 52 mg/100 gm.). The loss of this compound during cooking appeared to be directly related to the amount present before cooking.

No ascorbase was found in frozen broccoli. However, fresh broccoli contained considerable amounts of this enzyme.

Frozen broccoli obtained directly from the processor and stored for 253 days at 0° F. compared favorably to fresh broccoli in ascorbic acid content. Only slight decreases in reduced ascorbic acid and slight increases in dehydroascorbic acid and diketogulonic acid were detected as the result of the 253-day storage period.

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COMPOSITION AND QUALITY EVALUATION OF BOYSENBERRIES FOR FROZEN PIES

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The influence of harvest maturity on several chemical constituents of boysenberries grown in the Denair and Watsonville area of California was investigated. Accompanying maturation there was a decrease in titratable acidity and an increase in soluble solids content. The decrease in acidity was attributed to the decrease in citric and malic acids which were metabolized rapidly during maturation. Malic acid was found to decrease at a faster rate than citric acid. Cis-aconitic and isocitric acid were also found in smaller quantity. The change in sugars, tannins, pectin, and volatile reducing substances during maturation of the berries is reported. The importance of these chemical constituents to flavor and consistency of frozen boysenberry pies is discussed. Proper control of maturity of individually quick frozen (I.Q.F.) berries is essential to the quality of the frozen pie.

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EFFECT OF TEMPERATURE ON STORAGE STABILITY OF FROZEN CAKES

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Cakes are known to be well adapted to preservation by freezing, but successful application of the method requires careful appraisal of limitations of all steps in the procedures used. Results presented earlier indicate cakes to be relatively insensitive to variations in rates of freezing and defrosting. The present study now provides information on the stability of 5 kinds of commercial cakes at several subfreezing temperatures.

Angel food, chiffon, yellow layer, chocolate layer, and pound cakes were stored at 10°, 0°, −10°, and −30° F. At intervals, taste-panel comparisons were made against freshly baked control cakes to determine the time required for significant differences to occur in the frozen cakes. It should be emphasized that even after significant changes had occurred, the quality of the stored cakes was still quite good. They were superior to unfrozen cakes held for 24 hours at room temperature after baking.

Texture changes of the stored cakes were generally detected before changes in flavor. Principal texture changes were loss of original crumb resiliency and increases in crumbliness and harshness. Flavor gradually declined, to yield an increasingly bland product. Yellow and chocolate layer cakes exhibited relatively good stability at 10° F. and greatly improved stability at 0° F. However, little gain in stability was obtained at −10° and −30° F. Angel food and chiffon cakes showed poor to fair stability at 10° F., greatly improved stability at 0° F., and still further improvement at −10° and −30° F. Pound cakes were roughly intermediate in behavior to the other two pairs of cakes.

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TIME-TEMPERATURE TOLERANCE OF FROZEN FOODS. QUALITY CHANGES IN FROZEN SPINACH STORED IN RETAIL PACKAGES

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N. E. WEINSTEIN
U. S. Department of Agriculture, Agricultural Research Service
Western Regional Research Laboratory
Albany 10, California

Several lots of commercially packed spinach obtained under known processing conditions were subjected to constant and fluctuating storage temperatures in the range −20° to 40° F. Rate of chlorophyll conversion to pheophytin was constant with storage time for constant or symmetrical temperature conditions. It doubled for about every 5° F. increase in effective constant temperature in the range 0° to 25° F. Chlorophyll deterioration was a little more rapid in spinach than in peas but slower than in green beans. When judge's average visual-color scores for a series of samples increasing in deterioration were plotted against Hunter Color and Color-Difference Meter values and percentage intact chlorophyll, a similar systematic relationship was apparent. Decrease in ascorbic acid content and elapsed time for a detectable flavor change also indicated rapid deterioration in quality in the range 10° to 40° F. Package to package variation was a serious problem in ascertaining rates of deterioration. Factors that contributed to variability were non-uniformity of blanch, amount of residual water, number of yellow leaves, and amount of stems. Good packaging was necessary to prevent undue moisture loss. Temperatures as low as 0° F. were necessary to maintain good quality up to 8 months of storage.

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STUDIES ON FREEZING OF STARCH AND STARCH DERIVATIVE SYSTEMS

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An investigation was carried out to determine the effect of various processing variables on the stability, after freezing, storage and thawing, of slurries and white sauces prepared with various starches and starch derivatives. Overall objectives of the investigation were (1) to determine experimentally the effect of such physical variables as rate of freezing, storage time and temperature, shearing of granule systems, and heat treatment prior to freezing; (2) to utilize the information obtained above in an attempt to produce a typical white sauce system which would be stable to freezing temperatures, storage at these temperatures, and subsequent thawing at room temperature.

As long as slurries of regular corn starch were not heated above the critical gelatinization point of 163° F., these slurries remained essentially unchanged after freezing and thawing; however, when heated to temperatures above 163° F., severe retrogradation took place, resulting in typical starch sponge formation. After freezing and thawing, only a slight decrease was observed in the enzyme susceptibility of slurries of pregelatinized, cross-linked waxy maize starch, as compared to unfrozen samples. Various preheating treatments had no significant effect on the stability of frozen slurries of this starch, or of starch phosphate.

Standard white sauces were prepared with various starch thickening agents, and a control sample was prepared with all-purpose flour as the thickener.

Severe homogenization resulted in improved freeze-thaw stability of white sauces, but freezing in liquid nitrogen had no significantly beneficial effects. This was in direct antithesis to results obtained with simple starch-water slurries, and emphasized the important differences between these two systems.

Based on the results of experiments with both white sauces and starch-water slurries, thickening agents were rated in decreasing order of freeze-thaw stability as follows: starch phosphate; ungelatinized regular corn starch; pregelatinized, cross-linked waxy maize starch; flour; and pregelatinized regular corn starch.

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COMPARATIVE STORAGE STABILITY OF SELECTED PRE-COOKED FROZEN POULTRY PRODUCTS

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Four food products made from cooked chicken or turkey meat were frozen and stored at 0° F. for periods up to forty weeks. These products included a turnover, a salad mold, a chicken or turkey meat roll, and a timbale. The study was designed to determine the suitability of these products for use as pre-cooked frozen food items and to compare their storage stability when made from chicken and from turkey meat. Treatments included antioxidant level and pre-freezing treatments of ingredients. These products were tested for rancidity both organoleptically and chemically (peroxide values) after ten, seventeen, twenty-six,

thirty-two, and forty weeks of frozen storage. They were also judged organoleptically at these time intervals by comparison with a freshly prepared, frozen standard for such quality factors as color, flavor and texture.

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FREEZING AND THAWING RATES OF POULTRY MEAT

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Data were needed as to freezing and thawing rates of poultry meat held under varying conditions. These studies obtained data on relative freezing rates of poultry meat frozen in an immersion brine tank, liquid spray freezer system, and conventional air freezers. Thawing rates were obtained for poultry in air at different temperatures, packed in boxes of several constructions and immersed in running cool water. Freezing rates were obtained for packaged whole birds and thawing rates for whole birds and cut-up packaged birds.

The times required for the surface temperature of fryers to rise from 10° F. to 32° F. when held in boxes placed in a room at 68° F. were as follows: Completely aluminum laminated box, 27 hours; aluminum laminated box but plain fiberboard top, 15 hours; waxed box with plain fiberboard top, 15¾ hours; and a polyethylene laminated box, 13 hours. Similar observations were obtained for these boxes held at other room temperatures varying from 35° F to 55° F.

Freezing rates of poultry meat in liquid freezers are affected by liquid temperatures, rate of liquid flow and viscosity of the liquid. Comparisons were made using calcium chloride, sodium chloride and propylene glycol solutions.

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PREVENTING DARKENING OF MEAT NEAR THE BONE OF FROZEN POULTRY

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Experiment, Georgia

Darkening of meat near thigh and leg bones, of young chickens during freezing, thawing and cooking, detracts from the appearance of the product. The kind of feed, methods of bleeding, rate of chilling, and time of freezing storage had little or no influence on meat darkening. However, meat discoloration was prevented by heating the chicken parts to an internal temperature of 180° F. before freezing. This was accomplished, in order of preference, by heating with microwaves, live steam, deep fat at 350° F., radiant heat oven at 350° F., or steam pressure. Heating with microwaves was highly effective, required three minutes, and resulted in 19.6% moisture loss; heating with live steam was also effective, required 26 minutes and resulted in 17.4% moisture loss. Other methods were slightly less desirable.

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TIME-TEMPERATURE TOLERANCE OF FROZEN FOODS: READY-TO-COOK CUT-UP CHICKEN

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Western Regional Research Laboratory
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Frozen storage tests over a wide range of temperatures and times were carried out on commercial and experimental packs of cut-up chicken fryers and stewing hens. Evaluations were made of moisture loss, changes in appearance, peroxide development, off odors in the raw meat, and off flavors in the cooked product. In the course of storage deterioration, off odor in the thawed raw meat was the first quality defect to be detectable to a significant degree, followed by off flavors in the cooked products. Visible dehydration on the exposed surfaces of the cut-up chicken became appreciable after moisture loss from the package exceeded 0.5% of the carcass weight.

Chickens from all packaging conditions had a storage life of at least 6 months at 0° F. However, large differences in frozen storage stability were observed between commercial packs of fryers, due mainly to large differences in permeability between types of packaging. A storage test of cut-up fryers in sealed tin cans with controlled atmospheres was used to establish independently the deteriorative effects of oxygen (air) availability and moisture loss, both of which are characteristics of poor packaging. Moisture loss in itself was found to have little effect on organoleptic deterioration or chemical changes involving oxygen consumption. Access to the oxygen of the air, on the other hand, contributed as much to rate of deterioration as a substantial rise in temperature. Comparative results of tests at +20° F., +10° F., 0° F., −10° F., and −30° F. provided further evidence to support a recommendation for storage at 0° F.

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EXPERIMENTS ON FOOD PRESERVATION WITH A NEW ICE CONTAINING GLYCOL DIFORMATE AND SORBIC ACID

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A new ice for the preservation of poultry and other foods has been prepared in our laboratory containing 100–500 p.p.m. of glycol diformate, an equal amount of sorbic acid, and some 25 ml. of hydrochloric acid per ton of water. The acid is added to the solution of the other two ingredients just before the water begins to freeze in the flake-ice making machine. The above chemicals are more efficient for preservation when used in the form of flake ice, because in this case the active form of preservatives act in a "status nascendi," but can be also used in the form of solution for dipping purposes. Experiments were conducted on poultry, meat, shrimp, oysters, fruit, and vegetables, and in every case the beneficial effect of the new ice in comparison with the common ice and the antibiotic dip was definitely demonstrated. In the case of chicken, for instance, the final score of 5 experiments and of 5 different quality tests (bacterial count, organoleptic test, and three chemical tests) showed the following results (rating values run high when the quality runs low).

1) Control chickens (stored in common ice)	26
2) Chickens (dipped in antibiotic and stored in common ice)	23
3) Chicken stored in the new ice	11
4) Fresh chickens	8

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PROLONGING THE STORAGE LIFE OF FRESH BEEF BY USE OF A FILM IMPREGNATED WITH ANTIBIOTIC

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Microbiological spoilage, discoloration and dehydration are the primary factors limiting the storage life of sliced meats. The purpose of this study was to determine if a packaging film impregnated with an antibiotic could be used to limit the deteriorative action of these three factors. It was found that the keeping time of sliced fresh beef could be prolonged if the meat was wrapped in a packaging film (FM-1 Pliofilm) in which the antibiotic chlortetracycline (CTC) had been incorporated. Packaged samples of meat were stored in refrigerated display cases at 5, 10 and 15° C.; an inverse relation was shown between keeping time and temperature of storage. A 5° C., packaged steak wrapped in film containing 0.4 parts CTC/100 parts rubber hydrochloride did not develop off-odor or slime until 2 days after the control meat had shown similar signs of spoilage. Reflectance readings at 580 mμ and 635 mμ indicated a 2-day lag in discoloration for meat packaged in film impregnated with CTC. Studies with film containing smaller amounts of CTC in the rubber hydrochloride base also indicated less rapid microbial proliferation and less discoloration than did the control packages.

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MICROBIOLOGICAL ASPECTS OF PRESSURE PACKAGED FOODS. II. THE EFFECT OF VARIOUS GASES AND PACKING PROCEDURES

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The growth of several food spoilage microorganisms was inhibited when culture media were pressurized to 90 to 105 p.s.i. with carbon dioxide. Noticeable exceptions were the lactic

acid bacteria, *Bacillus coagulans*, *Streptococcus faecalis* and a yeast isolated from beer. This inhibitory action of carbon dioxide was found to be independent of the lowering of the pH of the media.

Nitrogen did not inhibit the growth of any of the test organisms, while nitrous oxide exerted a slight inhibitory action on some of the fungi tested.

Data from test packs indicate that products pressurized with nitrogen should be gassed while hot in order to prevent mold growth.

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PRESSURE DISPENSED LIQUID COFFEE CONCENTRATE

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In 1958 powdered Instant coffees accounted for approximately one third of the total home coffee consumption in the United States. The existence of a substantial market for this product relies mainly upon the convenience factor since flavor, in most instances, does not equal that obtained from fresh brewed coffee.

It now appears that it may be practical to market a liquid concentrate in an aerosol container which more nearly approaches fresh brewed coffee flavor. Progress in work designed to determine packing and storage conditions requisite to producing and retaining optimum product flavor and aroma are reported. This work falls mainly into three areas:

1. Inoculation studies with *C. botulinum* to determine growth and toxin producing potential of this organism in coffee concentrate.
2. Methods of producing a full flavored liquid concentrate, and
3. Product flavor sensitivity to heat and metal exposure in varying degrees.

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FLEXIBLE PACKAGING MATERIALS AND INERT GAS INCREASE SHELF LIFE OF FOOD PRODUCTS

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Notable improvements in the technology of flexible packaging materials have furthered the use of nitrogen processing of food products thus increasing their shelf life.

With the advent of new plastic films and improved methods of coating, combining and laminating basic packaging materials such as cellophane, pliofilm, foil, saran, mylar, and polyethylene, it is now possible to gas-package foods commercially in flexible containers. Packaging machinery manufacturers are designing and producing new equipment to flush out oxygen efficiency and incorporate inert gas within the product mix as well as the headspace above the product.

The new material constructions enable the packager to keep foods fresher, retain color, flavor, appearance, taste, and nutritive value and also offer product protection from chemical, physical, and mechanical damage.

Techniques are being developed to relate gas permeability of the packaging material and package construction to the expected shelf life of the food product.

The developments have enabled the producers of dried milk, dehydrated potato or vegetables, dry activated yeast, nut meats, fruit powders, oil-fried products, dry soup mixes, dried beef, sandwich meats, and other oxygen-sensitive foods to offer food products with greater shelf life and better quality.

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ALUMINUM PACKAGING—TODAY'S TRENDS AND TECHNIQUES

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This paper will endeavor to bring out some of the techniques used in making aluminum a usable material for food packaging in order to supplement the data already published as to how and why it is used. From this, some of the future trends in how it will be used will be predicted from work that is already underway.

A short time ago, the coating of hot plastic resins directly on substrates was strictly a curiosity. Today this technique is used to provide an economical means of commercially making aluminum material into packages that are leakproof to specific gases and that will hold an almost complete vacuum. Tomorrow it is believed that materials will be available that will be completely capable of sterilization under conventional steam pressures.

In other and related fields, technological developments have been accomplished that bring items like the aluminum can for food packaging closer to an accomplished fact than ever. A few years ago, resin systems that could be converted on high speed equipment were a laboratory curiosity. Today, coupled with new handling techniques, they are a reality.

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THE STABILIZING OF TIN PLATE SURFACES

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The surface of tin plate oxidizes during storage and because this oxide can detrimentally affect the adherence and the wetting by lacquers and lithographing inks, methods to stabilize tin-plate surfaces were investigated. The most important developments in this field are reviewed briefly, followed by a description of the development and testing of two processes for stabilizing tin-plate surfaces.

Several solutions containing salts of acidic-metal-oxides known to form complex polyacids were found to be promising for this purpose; of these, sodium dichromate was the most practical. To rapidly stabilize the surface of tin plate the tin plate is first treated cathodically in the passivating solution, and this is followed by chemical or electrochemical oxidation in the same solution.

The protective films formed by both of these methods are invisible but are effective barriers between metal and oxygen. The electrochemical reoxidation method produces films that are somewhat more stable, less easily damaged by abrasion and more resistant to sulfide staining, but films produced by this method are not entirely satisfactory with a few tin-plate lacquers. Therefore, films produced by the cathodic-reduction and chemical-reoxidation method are used commercially. The results of an evaluation of pilotline treated tin plate and of extensive warehouse storage tests of commercially treated tin plate are presented.

Although research is being continued in an attempt to produce protective films that are compatible with all tin-plate lacquers, it is hoped that new lacquers will be developed to replace the few with which the most protective films are not entirely satisfactory.

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FREON C-318 AND NITROUS OXIDE MIXTURES AS FOOD AEROSOL PROPELLENTS

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and
R. C. WEBSTER
Air Reduction Co., Inc., 1400 E. Washington Ave.
Madison 10, Wisconsin

Many aerosol whipped creams and related synthetic toppings when dispensed from an aerosol container tend to collapse upon standing. This collapse or loss of foam stability is generally accompanied, as in the case of true whipped creams, by a weeping effect and a loss of the creamy white color.

The factors of foam structure, foam rigidity, overrun, and color loss are evaluated for nitrous oxide, nitrous oxide–carbon dioxide mixtures, and other mixtures of compressed gases now applicable to aerosol food manufacture.

The effect of mixtures of nitrous oxide and Freon C-318 on the factors of foam stability, color retention, and other factors of quality is demonstrated. The addition of the liquefied propellent, Freon C-318 in small amounts to the compressed gas, nitrous oxide demonstrates a marked increase in foam stability and color retention.

The effect of temperature, pressure, and other critical product and storage factors are shown for this new mixture of compressed and liquefied propellent that is destined to improve aerosol whipped creams and toppings for the American Consumer.

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INVITING NOMINATIONS FOR THE

1959 Glycerine RESEARCH AWARDS

FIRST AWARD . . . $1,000

SECOND AWARD . . . $300 ***THIRD AWARD . . . $200***

These annual awards were established in 1952 to recognize research leading to new and improved applications of glycerine and glycerine derivatives. Award winning work may deal with the chemical, physical or physiological properties of these materials; with actual or projected uses; or with scientific principles likely to stimulate future applications. Originality in extending the usefulness of glycerine into new fields will receive special consideration.

BASIS OF ENTRY – These awards are open to any individual in the United States or Canada engaged in research, either in industry or with government or educational institutions. Entries by research teams of two or three associates are eligible.

First consideration will be given to work which has come to a clear-cut point of accomplishment during the current year; but work carried on in previous years, the significance of which has been confirmed by commercial application in 1959, also will be eligible.

Entries will be judged by a committee of three persons of outstanding reputation and scientific background, having no connection with the Association or its members.

METHOD OF NOMINATION – Nominations must be made on the official entry blank, which may be obtained by writing to: Awards Committee, Glycerine Producers' Association, 295 Madison Avenue, New York 17, N. Y.

All nominations for the 1959 awards must be received by November 1, 1959 to be eligible.

1958

First
L. A. Goldblatt and R. S. McKinney
U. S. Department of Agriculture

Second
Dymtro Buchnea, University of Toronto

Third
Herman B. Wagner, Tile Council of America

1957

First
James L. Tullis
Harvard Medical School

Second
Guido V. Marinetti
University of Rochester

Third
C. G. Youngs and Henry R. Sallans
National Research Council of Canada

1956

First
Herbert J. Dutton
U. S. Department of Agriculture

Second
Donald Zilversmit
University of Tennessee

Third
Stanley G. Knight
University of Wisconsin

1955

First
Reed A. Gray
Merck & Co.

Second
Eugene P. Kennedy
University of Chicago

Third
Karl H. Lauer
University of Alabama

1954

First
Robert K. Summerbell
Northwestern University and
James R. Stephens, American Cyanamid Co.

Second
Two research teams:
Robert W. Swick and Akira Kakao
of Argonne National Laboratory and
Harland G. Wood and Per Schambye
of Western Reserve University

Third
Henry A. Sloviter, University of Pennsylvania

1953

First
Erich Baer, University of Toronto

Second
Lewis I. Gidez
Brookhaven National Laboratory and
Manfred L. Karnovsky
Harvard Medical School

Third
Albert C. Nuessle, Rohm & Haas and
Russell F. Crawford, Jr., Sharon Hill, Pa.

GLYCERINE PRODUCERS' ASSOCIATION • 295 MADISON AVENUE, NEW YORK 17, N. Y.

230D

(Continued from page 230 preceding program section)
The influence of tin crystal size was quite apparent in this instance; all of the failed cans had small crystals, but no hydrogen swells occurred in cans made of plate with large crystals.[c] Needless to say, the industry quickly recognized the implications and has undertaken a major program to consistently produce plate with large tin crystals.

After storage with some products No. 100-25 plate exhibits a difference in appearance from hot dipped plate. An example of this difference has been reported by Kohn and Fix *(6)* in work on applesauce cans where a black line of detinning in the headspace was observed. This type of corrosion is also encountered with hot dipped plate but is less conspicuous because of the lighter color of the tin-iron alloy layer.

Identification of the No. 25 surface. As mentioned earlier, when No. 100 plate was being considered for commercial use, No. 100-25 differentially coated electrolytic plate became available, affording additional savings in tin. In the use of No. 100-25 plate it is imperative that the heavy coated No. 100 side of the plate be on the inside of the fabricated can part. Consequently, it has been necessary to identify one side or the other to prevent errors.

Several marking systems are being used for this purpose. One method used a somewhat rough finish on one surface of the base steel which is visible after coating with tin. A second method uses chemicals to impart a satin-like luster to one surface, either overall or in a pattern.

External rust. While it was recognized from the outset that the No. 25 surface of differentially coated plate is inherently less resistant to external rusting than hot dipped plate, it was demonstrated that the surface was essentially equivalent to the No. 25 plate with respect to rust resistance. The latter material has been used extensively for cans for many of the mildly corrosive products like corn and peas. Successful experience with these No. 25 cans has indicated that most packers would be able to use the No. 100-25 cans without any problem of container rusting. At some canneries, however, conditions are too severe to allow the use of differentially coated plate. For such cases, No. 100 electrolytic has proven to have the equivalent rust resistance of hot dipped plate while still affording some savings in cost.

Future prospects. With differentially coated No. 100-25 tin plate now established as a standard food container material, a continued reduction in the amount of hot dipped plate used for food cans may be expected for the next few years. The eventual elimination of hot dipped plate depends on two factors. First, information as to the suitability of No. 100-25 plate for some products is lacking and must be acquired. Second, most of the present No. 100-25 electrolytic does not provide adequate shelf life for certain food products and improved corrosion resistance is needed.

It has not been practical thus far to evaluate No. 100-25 for all products being packed in hot dipped plate, since, logically, the initial transition was concentrated on the large volume products classed as slightly or moderately corrosive. Current efforts now are being directed toward smaller volume items.

The problem of extended usage of No. 100-25 plate has been further complicated by continued introduction of new "formulated" products whose corrosive characteristics are not always predictable. Continued progress is being made in the evaluation of No. 100-25 plate for the small volume formulated products which will undoubtedly result in finding additional applications for differentially coated plate.

Until No. 100-25 plate is available with the required corrosion resistance for all products, the canner of a hard-to-hold food product has the choice of continuing to use the more expensive hot dipped plate or No. 100-25 plate. In the latter case, he must realize that the time for disposition of the product is restricted. This latter choice is possible with non-seasonal products which may be packed to order the year around. It is also conceivable that electrolytic plate with a heavier tin coating, such as No. 125-25 or No. 150-25 may prove to be a practical solution for some products for which No. 100-25 plate does not provide adequate shelf life. Studies of plate with these heavier tin coatings have been in progress during the last year.

The problem of improving the corrosion resistance of No. 100-25 plate to provide performance equivalent to hot dipped plate for the highly corrosive products has been the subject of intensive investigation for many years. This study has been a cooperative effort of both the tin plate producers and the can manufacturers. The decline in the amount of risk-producing, low corrosion-resistant material illustrated earlier shows that this cooperative effort is bearing fruit. It seems reasonable to predict elimination of this risk producing material and, that with a general rise in average corrosion resistance level, the virtual elimination of hot dipped plate for the packaging of foods may be realized in the next few years. The economies resulting from use of No. 100-25 plate will then be fully realized.

Savings are directly related to the lower price of electrolytic plate and are augmented by the savings which can be obtained by the use of coils rather than cut sheets, in can manufacturing operations. Can manufacturers have just entered into coil operations in the last year on electrolytic plate *(3)*; hot dipped plate is produced only in cut sheets and is not obtainable as coils.

Predictions of the future of electrolytic plate would not be complete without reference to the subject of tin coatings lighter than No. 100-25. Experimental work indicates that there may be some promising applications for No. 75-25 electrolytic plate, plate with the equivalent of No. 75 in place of No. 100 on one surface. More comprehensive studies and improved corrosion resistance are a necessary prerequisite to the introduction of such plate.

Enamel coatings have had an important part in the change from hot dipped to electrolytic plate and there

[c] The ASTM standards for grain size of non-ferrous metals at a magnification of 1X are used for classification of tin crystal size. Large crystals are those of size ASTM 9 or larger.

is no reason to believe that the development of coatings is at an end. As one of the long term trends, we can expect improvements in organic coatings which will permit the use of even lighter tin coatings.

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Commercial-Scale Evaporation of Tomato Products in Flash Evaporators[a]

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(Manuscript received August 26, 1958)

Tomatoes are low in solids content compared with other fruits. For this reason, they can be preserved, stored, and transported most economically after concentration to the greatest degree compatible with their final use. Tomatoes are the fourth most valuable western fruit or vegetable and easily the second in volume. For these reasons, problems involved in the evaporation of water from tomato products receive careful consideration.

The requirements for commercial tomato evaporators are production of high-quality product, capacity for uninterrupted operation, and high efficiency, in that order of importance. These requirements must be considered in connection with current trends toward smaller labor forces, high-volume production, and high-solids products. In regard to product quality, important factors are stainless-steel construction, low wall temperatures, and accurate control of enzyme reaction times. Of dominant importance, since they affect both product quality and ease of operation, are those factors involved in the rate of fouling of the heating surfaces by tomato.

Fouling is the result of reactions of various components of tomatoes resulting in deposition of solids on the hot metal surface. For any material, the rate of fouling increases with concentration of reactants and with temperature of the liquid in the immediate vicinity of the heated wall. This temperature can be reduced either by reducing the temperature of the hot side of the wall, or by decreasing heat-flow resistance between the hot metal and the boiling material so that larger temperature drops occur in the heating medium and within the wall. The latter method results in more evaporation per dollar invested and per cubic foot of space occupied. This was the basic idea behind the flash evaporator.

Flash evaporators were designed at the Western Regional Research Laboratory, Albany, California, in 1951 by A. H. Brown and others *(3)*. Some of these authors had previously described the advantages of steam injection heating *(2)*. The original devices were used as strippers of essences and odors. In this capacity, evaporation capability was secondary, and attention was fixed on heat treatment in the injector and on means of enrichment and recovery of volatiles *(8)*.

[a] Presented at the Eighteenth Annual Meeting of the Institute of Food Technologists, Chicago, Ill., May 28, 1958.

[b] Western Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

PILOT PLANT EQUIPMENT

The basic apparatus is shown in Figure 1. Preheated feed is forced by a gear pump at a steady rate through a check valve into the injection heater. In the pilot plant model, this heater is a 14-in.-long section of 1-in. stainless-steel tubing. Clean steam is admitted through a sharp-edged orifice $\frac{5}{32}$ in. in diameter directly into the feed, where it rapidly condenses. The steam jet is nearly tangent to the inside surface of the injector body and subtends an acute angle to the direction of liquid flow. The length of the injector is chosen so as to produce the desired retention time at the injector temperature. A valve or orifice at the end of the injection section maintains a pressure higher than the saturated pressure for the temperature attained by the feed. When the feed passes this restriction it cools by evaporation into the lower pressure zone; that is, it

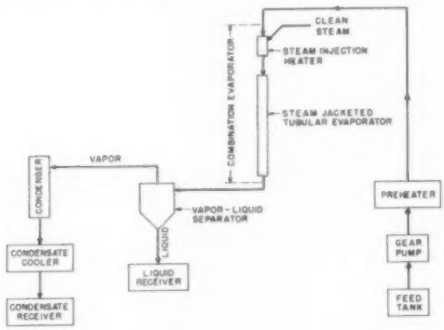

Figure 1. Western Regional Research Laboratory flash evaporator.

is said to flash. The resulting saturated mixture of steam and liquid has a much higher specific volume than the liquid alone and therefore enters the evaporation section with a high average linear velocity. This evaporator is a single $\frac{3}{4}$-inch, 18-gage, stainless-steel tube inside a 6-foot length of 2-inch pipe which acts as a steam jacket. As additional feed is vaporized, the average linear velocity increases still further. The effect of this high velocity is to decrease resistance to heat transfer from the inside of the tube wall to the boiling feed. Vapor and concentrated product pass into a 14-inch-diameter centrifugal separator, from which vapor flows to a condenser, and the concentrated liquid is removed and cooled or recirculated.

PILOT PLANT EXPERIMENTS

Pilot plant studies on this unit have included the concentration, stripping, and recovery of essence from various fruits. Milk has been deodorized and pasteurized. The mechanism of steam-injection heating has been studied *(5)*. A basic study of evaporation factors concerned in fouling is being completed.

For all materials tested in the short runs in the pilot-plant flash evaporator, heat transfer was good and fouling was a minor problem under mild conditions of operation. The overall heat-transfer coefficient is defined by

$$U = \frac{q}{A(\Delta t)_M} \qquad (1)$$

where U = overall heat transfer coefficient, Btu/hr. ft.^{2} ° F.
A = inside tube area, ft.^{2}
$(\Delta t)_M$ = log mean difference in tempreature between the condensing steam and the liquid boiling at the prevailing pressure inside the tube.
q = heat transferred, Btu/hr.

Values of this coefficient were measured for a variety of conditions and products in the pilot plant unit as a practical measure of evaporative capacity. For purees in a clean tube, the coefficients averaged 1100 Btu/hr. ft.^{2} ° F. This is to be compared with values of 100 to 400 Btu/hr. ft.^{2} ° F. for conventional equipment.

PLANT SCALE EQUIPMENT

As one result of this work, a number of commercial-scale flash evaporators were installed in food processing plants. Some of these units have been described *(1, 6, 7)*. At least 15 commercial installations are now in operation in the United States and abroad. These range in size from 200 to 7,000 gal. per hour.

The commercial tomato processing plant observed is located in central California. Further data were obtained for comparison at a second plant in the same area. Flash evaporators were installed in these plants by an equipment manufacturer in 1953–54. The units were used with tomato macerate, juice, and pastes of both 25% and 30% solids content. The scheme of operation is shown in Figure 2.

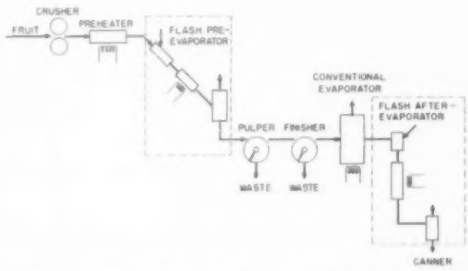

Figure 2. Commercial tomato processing line using flash evaporation.

The injector sections of the 3 pre-evaporators are used to heat-treat the tomato macerate so as to inactivate pectic enzymes, increase color separation from the pulp, and decrease waste removed by the finishers. The evaporation sections remove water from the macerate so as to achieve considerable net evaporation in the unit as a whole, although the macerate leaving the unit is still below 8% solids content. The macerate passes through the flash pre-evaporator only once. After pulping and finishing, the juice is concentrated by several conventional evaporators. A portion of the paste may be processed finally in the flash after-evaporator before canning.

The injectors for the flash pre-evaporators are 3-in. pipe sections, 4 ft. long, with 5 sets of steam entries, each set consisting of 12 $\frac{5}{32}$-in. holes. Rates of steam injection are controlled by injector liquid temperatures. The injectors are connected to the evaporators through gate valves which had been notched to avoid shutoff. Each evaporator section is composed of nine $1\frac{1}{2}$-in. 16-gage stainless-steel tubes about 22 ft. long. These tubes are inserted in an 8-inch pipe shell. Transverse shell baffles are spaced at 5-foot intervals.

The injector section of the flash after-evaporator is 3 ft. of 2-in. pipe with 2 sets of steam entries, each set consisting of 21 $\frac{5}{32}$-in. holes. As before, injector temperature is automatically controlled. Feed flashes through a notched gate valve into the evaporation section, which is composed of 38 $\frac{3}{4}$-in. 18-gage, stainless-steel tubes, 30 ft. long. These tubes are inserted in a 10-in. pipe shell with transverse baffling. The centrifugal separator is maintained at such a temperature that the paste may be canned directly. Recirculation is provided so that tube mass velocity up to 125 lbs./sec. ft.^{2} can be achieved.

RESULTS OF PLANT OPERATION

Heat treatment of macerate in the flash pre-evaporators achieved excellent pectin control. De-esterifying enzymes were destroyed within 0.1 second in the 250° F. injector regardless of preheater temperature, as judged by the alcohol precipitate test *(4)*. Variation in preheater temperatures permitted selection of moderate to very hot break results.

The redness of the waste material was spectacularly reduced, apparently because flashing improved extraction from all parts of the tomato. Product color was judged good.

The yield of tomato paste increased from 91.0% to 92.4% for roughly comparable weeks as a result of flash evaporation. This change in yield is based on actual input and output, together with half-hourly sampling of input and output solids content.

Results of the tests of evaporation are shown for typical conditions in the flash pre-evaporators in Figure 3. The horizontal distance is equivalent to $6\frac{2}{3}$ days' continuous operation on 6% macerate. This quantity is

$$W = \int \frac{U\,(\Delta t)\,d\theta}{\lambda} \qquad (2)$$

where W = evaporation since cleaning in lbs./ft.^{2}
θ = time since evaporators were clean, in hours
λ = latent heat of vaporization in Btu/lb.

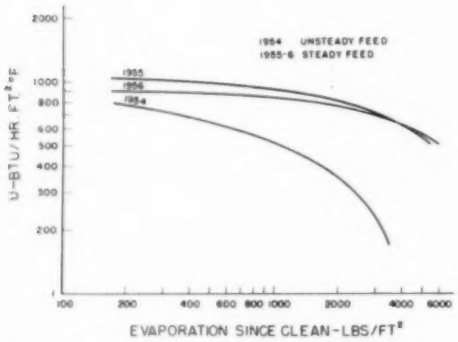

Figure 3. Flash pre-evaporator performance on tomato macerate.

This quantity, W, is the economically important factor. The average evaporation for the week can be calculated at 31 lbs./hr. ft.^{2} for good operation. On this type of plot, important fouling is indicated by sharp downward curvature. These data all follow the relation

$$\frac{1}{U^2} = a + b\theta \qquad (3)$$

where a and b are constants determined by conditions of operation. This is equivalent to saying that the heat transfer resistance of fouling is directly proportionate to the amount of water evaporated at the hot surface since it had been cleaned. Therefore, it is possible to calculate back to U values at zero time. This U_o value is about 1100 Btu/hr. ft.^{2} °F. for the commonest condition of operation on macerate.

By these means of calculation, values of U_o for other evaporators on comparable feeds range from 100 to 400 Btu/hr. ft.^{2}. This range includes single and double effect units, units with and without recirculation and with both upward and downward flow inside tubes. This comparison alone does not show the important factor of relative fouling rates for separate evaporators, but it does indicate the level of clean performance.

Figure 4 shows the effect of shell steam pressure on fouling of the flash pre-evaporators. For the $6\frac{2}{3}$ days' operation, 30 p.s.i.g. was the most effective pressure tested. For shorter periods, higher pressures would have been better.

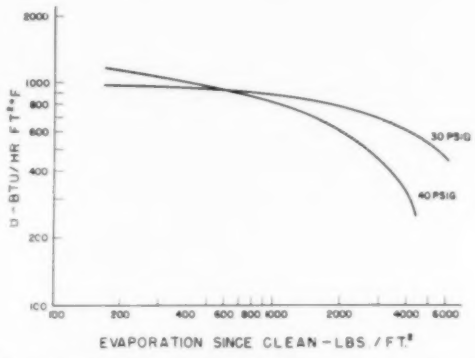

Figure 4. Effect of shell pressure on flash pre-evaporator performance on tomato macerate.

Figure 5 shows the effect of entrance velocity. This velocity is controlled by choice of injector temperature. The hotter the injector liquid, the greater the fraction flashed on entering the evaporator section and hence the higher the average entrance velocity. There is almost no effect on fouling; but U values are raised by increasing entrance velocity within the practical limits chosen. This suggests that the layer of liquid immediately on the wall is thinned by increasing average velocity, but not accelerated. Since injector temperatures were above the separator temperature, no dilution-effect difference need be considered. Economy of injection steam is the factor which limits the choice of entrance velocity.

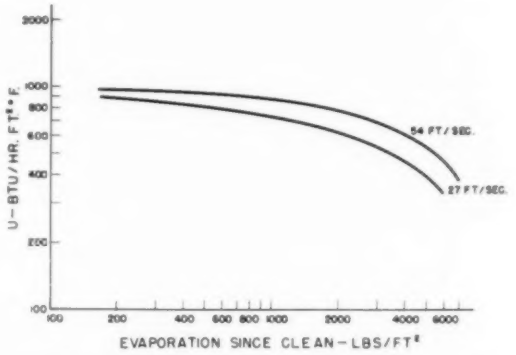

Figure 5. Effect of entrance velocity on flash pre-evaporator performance on tomato macerate.

Figure 6 shows the results concerning the flash after-evaporator. Notice that the abcissa is the product of average feed solids and the pounds of

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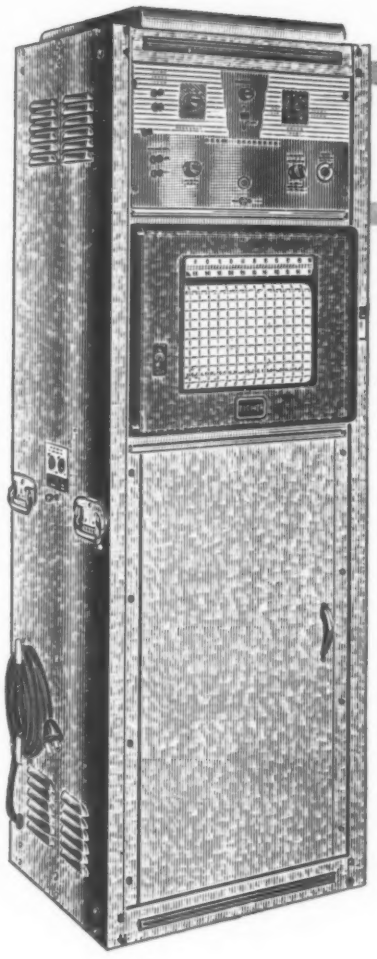

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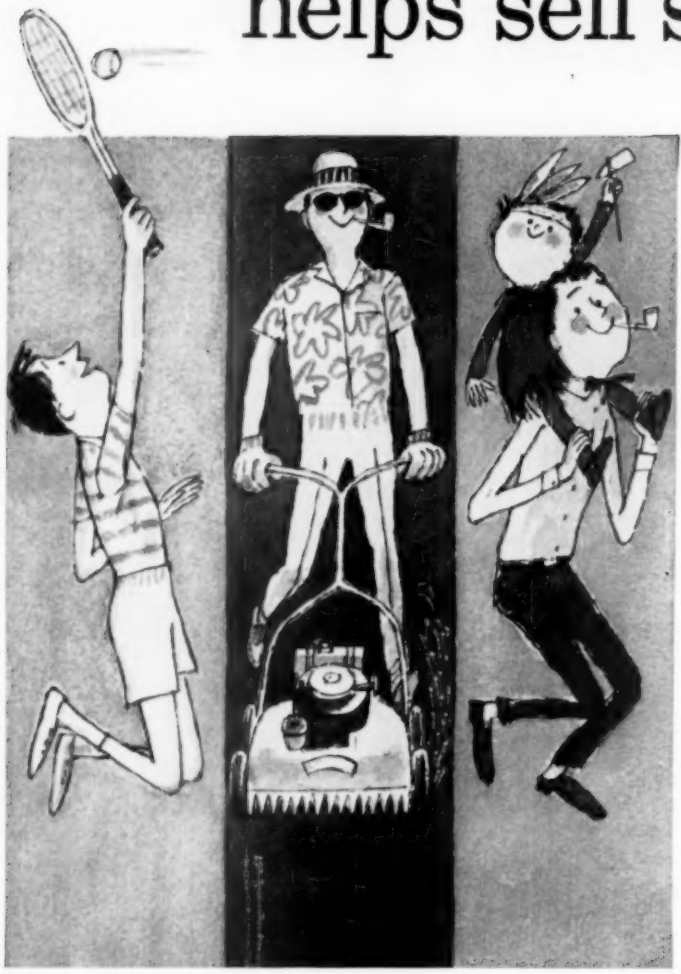

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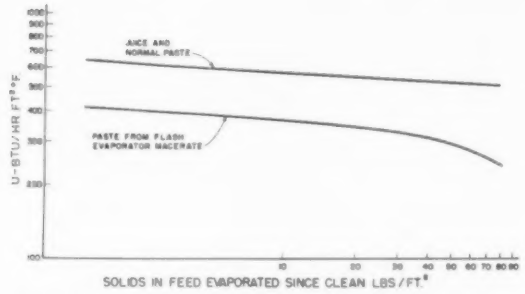

Figure 6. Flash after-evaporator performance on several tomato products.

evaporation per square foot since the tubes had been cleaned. In this way, results of tests on feed of various solids contents can be compared directly while retaining the economic significance of the horizontal distance. The maximum length of paste operation plotted is 24 hours. Severe fouling occurred with long runs on tomato paste of solids content ranging from 18% to 30% regardless of conditions. For finished juices of solids contents ranging from 7% to 12%, runs of at least 3 days were possible without objectionable fouling. Entrance velocity was ineffective in regard to fouling, as it was on macerate. Rates of fouling were at two levels, high for mass velocities below 70 lbs./sec. ft.^{2}, and lower for mass velocities above 70. Figure 6 shows an average for all conditions. The results fall on two curves, the upper showing slow fouling with any finished juice, or with paste not produced from flash evaporated macerate. The lower curve shows a more rapid fouling from paste which had been flash evaporated as macerate. This suggests that the additional cell rupture produced by flash pre-evaporation and the resulting more finely fragmented insoluble solids are factors which increase the difficulty of concentrating tomato paste. Fouling was evident, however, for all runs involving paste regardless of its history.

SUMMARY

Commercial flash evaporation of tomato macerate increases quality and yields of paste as well as providing a substantial net evaporation. Flash evaporation of finished juice as a step in paste or puree production is a practical process of low cost. Paste evaporation for runs longer than a few hours is impractical with the present equipment, especially with paste from flash-evaporated macerate. Additional research is under way to correct this deficiency and to improve general understanding of the process of fouling in evaporator tubes during concentration of heat-sensitive materials.

Acknowledgments

The authors are indebted to Thornton Canning Co., Thornton, California, and to Oscar Krenz and Co. of Berkeley, California, whose cooperation formed the basis of this paper.

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The Effect of Fatness on Some Processing and Palatability Characteristics of Pork Carcasses[a,b]

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Department of Animal Husbandry, Food Technology Program, Michigan Agricultural Experiment Station

(Manuscript received November 17, 1958)

THE SURPLUS LARD PROBLEM has stimulated production of leaner, meatier hogs. However, little consideration has been given to the possible effects of carcass leanness with respect to the color of lean, cure loss, defrosting drip, cooking loss, taste panel scores or tenderness.

It was found *(2)* that although a majority of consumers preferred the leaner cuts of pork, the reason most frequently given for those persons choosing the cuts with more finish was the "apparent" freshness, even though all cuts had been made at the same time. A low but significant correlation between marbling and tenderness has been reported *(4, 5, 6)*. Low but significant correlation between muscle fiber extensibility and taste panel score or shear value was obtained *(11)*.

Orme *(7)* found that per cent cure loss was inversely proportional to degree of finish, but found no significant difference between degree of finish of pork loin roasts and total cooking loss. Alexander *(1)* reported the ratio of evaporation loss to drip loss was less with higher finished beef roasts as compared to lower grade roasts, whereas the total cooking loss did not deviate to the same extent as the other two components, i.e., drip loss and evaporation loss.

Breidenstein, Bull, Forbes, and Stouffer *(3)* found little relationship between subjective evaluation of marbling and specific gravity of the rib eye, whereas the ether extract of the rib eye seemed to show positive relationship with marbling. However, other workers *(8)*, using the *Longissimus dorsi* from the 9-10-11 rib cut of 51 beef ribs, found correlation coefficients between specific gravity and per cent fat, water, protein and grade to the nearest one-third to be −.81, .76, .68 and −.68, respectively.

This study was undertaken to observe the effects of pork carcass finish upon color of lean, cure loss, defrosting drip loss, shear, total cooking loss and taste panel acceptability. In addition, the use of specific gravity as an objective measure of marbling and the use of muscle fiber extensibility as an objective measure of tenderness were studied.

MATERIALS AND METHODS

Experimental animals and cutting procedures. Three finish groups (av. backfat thickness of 1.0–1.3, 1.3–1.6, 1.6–1.9 inches) were studied with 25 carcasses in each of the 3 groups. The 75 carcasses were selected from hogs which came from various experiments ranging in live weight from 186 to 214 pounds. No attempt was made to select carcasses according to breed or nutritional background. The hogs were handled, slaughtered, cut and measured in the same manner as reported previously *(9)*.

Color measurements. A chop was cut from the right loin at the 10th rib and all bone and external fat removed from the *Longissimus dorsi*. The sample was placed in a partially inflated Cry-O-Vac bag and then held in a 36° ± 2° F. cooler. Samples were removed from the bag and color measurements taken at the end of 2, 24 and 48 hours. Disk colorimetry for the measurement of surface color of meats and the calculation of Munsell renotations were the same as described by Voegeli *(10)*.

Curing procedure. The basic curing formula used for both hams and bacons consisted of 8 lbs. of salt, 2 lbs. sugar, 1½ oz. of $NaNO_2$ and 1 oz. $NaNO_3$. Three-fourths of an ounce of the dry cure mixture per pound of bacon was rubbed on the surface. Bacons were placed in a standard metal bacon box and cured for 11 days at an ambient temperature of 36°–40° F. The bacons were then smoked for approximately 8 hours to an internal temperature of 120° F. Hams were cured by artery injection of an 86° pickle to an increase of 10% over green weight. A light application of dry cure mixture was rubbed on the surface of the hams. The hams were placed on a shelf for 13 days and then smoked approximately 12 hours and to an internal temperature of 142° F. Cooled bacon and ham weights were used for the calculation of cure loss.

Defrosting drip loss. Defrosting drip losses were obtained for the Boston butt, 10th to last rib section of one loin and all the ¾ inch thick loin chops which could be cut from the 3rd to 10th rib section of one loin. The frozen samples were weighed to the nearest gram and placed in Cry-O-Vac bags which were then placed in a 36° ± 2° F. cooler for 48 hours. The difference in weight between the frozen sample and at the end of 48 hours was considered defrosting drip loss.

Shear. Two loin chops were cut one inch thick at both the 8th and 9th rib and at the last rib. The chops were defrosted for 24 hours and then deep fat fried at 300° F. to an internal temperature of 170° F. Weights were taken before and after cooking for calculation of cooking loss. Seven one-half inch diameter cores were removed from the *Longissimus dorsi* of the two chops at each location and tested for maximum shear force by the Warner-Bratzler shear.

Cooking procedure. Ham slices and loin chops were prepared for the taste panel by roasting in a 300° F. oven to an internal temperature of 170° F. Bacon slices were roasted in a 350° F. oven until medium done as estimated by visual observation. Weights were taken before and after cooking for determination of total cooking loss.

Taste panel procedure. The 9-point hedonic scale (1 = *dislike extremely* and 9 = *like extremely*) was used to rate the samples independently in terms of degree of like or dislike. Twelve members served for each panel; however, the same 12 did not necessarily serve on each panel used on this project.

Specific gravity and chemical analysis. The procedure used for the objective measure of marbling by means of specific gravity and the procedure for ether extract and moisture were identical to those described *(8)*, with the exception that the *Longissimus dorsi* was excised from the 10th to last rib portion of the right pork loin.

[a] Data from a thesis submitted by R. L. Saffle in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

[b] Journal Article No. 2316, Michigan Agricultural Experiment Station.

[c] Present address: Dept. of Animal Husbandry, South Dakota State College, Brookings, South Dakota.

Muscle fiber extensibility. One loin chop was cut 1½ inches thick at the 10th rib and cooked to an internal temperature of 145° F. in deep fat (300° F.). The *Longissimus dorsi* was removed and refrigerated in a closed container for 24 hours. The detailed procedure for determination of muscle fiber extensibility of this sample was the same as outlined *(11)*.

RESULTS AND DISCUSSION

There was a consistent difference in the color of the *Longissimus dorsi* muscle between the three finish groups (Table 1) The renotation values do not lend themselves to statistical analysis. As the degree of finish increased, the hue of the lean changed from a low yellow red to a more yellowish red color. The value also increased, which indicated a lighter color. There was little difference in chroma, or the amount of respective colors. As the time after cutting the sample increased, the change in color, regardless of amount of finish, appeared to be as follows: hue changed from a low red range to a more yellowish red range; value remained fairly constant, while chroma increased to some extent from the 2 hour to the 24 hour reading and then remained the same at the 48 hour reading. No attempt was made to ascertain whether the differences in color between the finish groups were due to marbling *per se* or whether there were chemical and/or physiological factors involved.

TABLE 1
Average Munsell renotation

B.F. (in.)	Time after cutting		
	2 hours	24 hours	48 hours
1.0–1.3	2.6 YR 5.4/4.0	3.5 YR 5.4/4.4	4.6 YR 5.1/4.3
1.3–1.6	2.7 YR 5.6/4.2	3.5 YR 5.6/4.6	4.8 YR 5.6/4.6
1.6–1.9	3.3 YR 5.7/4.2	4.1 YR 5.7/4.3	5.4 YR 5.7/4.3

Mean values for cure loss for both bacon and hams are presented in Table 2. It was noted that there was 3.21 and 1.9% more cure loss for bacons and hams, respectively, from the leaner group than from the fatter group. These differences proved to be highly significant for bacon but lacked significance in the case of the hams (Table 3). Considerable variation occurred within each of the ham groups and this may have been partially due to the difficulty in injecting exactly the proper amount of curing pickle per ham. The procedure for ham curing was similar to that used commercially, whereas, in commercial practice most bacons are cured by needle injection of the pickle. The results of this study would indicate that the curing procedure should be different for those hams and bacons coming from leaner carcasses as compared to those coming from higher finished carcasses in order to obtain the same yield.

TABLE 2
Means and standard deviations for percent curing loss and defrosting drip loss

	Av. backfat thickness		
	1.0–1.3	1.3–1.6	1.6–1.9
Cure loss			
Bacons	13.89 ± 1.69	12.84 ± 2.57	10.68 ± 1.65
Hams	−0.98 ± 2.62	−0.67 ± 1.75	+0.02 ± 1.78
Drip loss			
Loin chops 3-10th rib	2.80 ± 0.77	2.29 ± 1.04	1.57 ± 0.42
Loin roast 10-last rib	0.70 ± 0.51	0.64 ± 0.43	0.54 ± 0.24
Boston Butt	0.58 ± 0.24	0.54 ± 0.40	0.40 ± 0.46

TABLE 3
Analysis of variance of curing loss and defrosting drip loss

Source	d.f.	Cure loss		Defrosting drip loss		
		Bacons M.S.	Hams M.S.	Loin chops 3–10th rib M.S.	Loin roast 10–last rib M.S.	Boston butt M.S.
Total	74					
Finish	2	67.08**	5.80	9.09**	.255	.235
Error	72	4.26	4.54	.634	.173	.145

** $P<.01$.

The mean values for the defrosting drip loss indicated less drip as degree of finish increased in all 3 cuts studied (Table 2). Analysis of variance showed highly significant differences between drip loss for the loin chops and degree of finish (Table 3), however, the differences were not significant for the loin roasts or Boston butts. The loin chops had more surface area per unit of weight which may account for the difference in the amount of drip between the chops and the other two cuts studied. The overall range in drip loss of the loin chops was from .98 to 6.18%, whereas the per cent loss for the Boston butt and loin roasts was over one per cent in only a few cases.

Correlations between the amount of fat in each of the 3 cuts studied as measured by either ether extract or specific gravity, and the per cent of drip loss were highly significant in all cases. Although the relationships were significant, they were rather low (Table 4). Results of this study indicated that degree of finish influenced the amount of drip loss.

TABLE 4
Simple correlations between various drip losses and various measurement of fat

Item studied	"r"
Ether extract X % drip of loin section 10–last rib	−.35
Specific gravity of *Longissimus dorsi* X % drip of loin section 10th–last rib	.40
Ether extract X % drip of chops 3–10th loin section	−.53
Specific gravity X % drip of chops 3–10th loin section	.51
Specific gravity X % drip of Boston butt	.45

"r" needed for P.01 = .302.

Mean values for the taste panel scores of the loin chops were 6.40, 6.58 and 6.93 from the carcasses which had 1.0–1.3, 1.3–1.6, and 1.6–1.9 inches of average backfat, respectively. Although the taste panel scores were within a rather narrow range, the differences were highly significant (Table 5). However, the taste panel results for hams and bacons did not approach significance. Perhaps one of the reasons for this fact was the variation which resulted from curing and smoking. It was observed that the leaner bacons were more salty than the fatter ones even though the same amount of cure per pound of green weight was used. Also, there appeared to be some variation in the saltiness and color of the hams within each group.

TABLE 5

Analysis of variance for taste panel scores, extensibility and shear

Source	d.f.	Taste panel			Extensibility M.S.	Shear-chops	
		Loin chops M.S.	Bacons M.S.	Ham M.S.		8–9th rib M.S.	2nd lumbar M.S.
Finish	74						
Total	2	1.855**	.175	.10	12.41*	10.94*	4.06
Error	72	.172	.382	.224	2.18	2.29	1.84

* P<.05.
** P<.01.

Analysis of variance revealed significant differences for muscle fiber extensibility and for shear of the 8th and 9th rib chops. However, no significant differences were found for the shear of the loin chops at the second lumbar vertebra (Table 5). Simple correlations were calculated for the loin chops between two mechanical measures of tenderness, two objective measures of marbling and taste panel scores for the loin chops. In addition, a multiple correlation between ether extract, shear and scores of the taste panel was calculated (Table 6). All correlations were

TABLE 6

Correlations between shear, extensibility, various measurements of marbling and taste panels scores of Longissimus dorsi

	Taste panel (2nd lumbar)	Shear		Extensibility (10th rib)
		2nd lumbar	8–9th rib	
Specific Gravity (10–last rib)	−.38	.42	.39	.34
Ether Extract (10–last rib)	.31	−.48	−.46	−.33
Extensibility 10th rib)	−.48	.59	.59	.....
Taste Panel (2nd lumbar)	.....	−.40	.....	−.48
Ether Extract x Shear (10–last rib) (2nd lumbar)	.42	.....	.....	.....

"r" needed for P.01 = .302.

relatively low but highly significant in each case. It is emphasized that the taste panel members only recorded their degree of like or dislike of the product and did not indicate why they scored as they did, therefore, more conclusive statements could not be made in this respect.

Analysis of variance revealed that total cooking loss was not significantly different between finish groups, regardless of method of cookery or the cut of meat, with the exception of total bacon cooking loss, which was significant at the 5% level (Table 7). These results may be partially explained by the fact that total cooking loss is not affected by the degree of finish to the extent of cooking drip loss (directly related to finish), and cooking evaporation loss (inversely related to finish). Bacon is somewhat of a special case as it is a fat cut, the slices are quite thin and it is cooked to a higher degree. Thus, total cooking loss increases as the amount of finish increases.

When specific gravity, ether extract and moisture were grouped according to the 3 finish groups, there was tendency for overlapping between groups. This would be expected as backfat is only associated with marbling and not a measure of it. Correlation coefficients of −.50 and .41 were found between backfat and specific gravity, and backfat and ether extract of the *Longissimus dorsi*, respectively. However, highly significant differences were found for specific gravity, ether extract and a significant difference for moisture (Table 7). The correlation coefficient between specific gravity and per cent ether extract of the *Longissimus dorsi* was −.83 while the correlation between specific gravity and per cent moisture was .73. The estimating equation for specific gravity and per cent ether extract was $Y = 469.38 - 434.42X$, where $Y = \%$ ether extract and $X =$ specific gravity, with a standard error of the estimate of 1.94%. The estimating equation for specific gravity and per cent moisture was $Y = -186.88 + 241.65X$, where $Y = \%$ moisture and $X =$ specific gravity, with a standard error of the estimate of 1.61%.

SUMMARY AND CONCLUSIONS

This study was designed to observe the effects of different degrees of finish on various processing and palatability characteristics of pork carcasses. In addition, the use of specific gravity as an objective measure of marbling and the use of single muscle fiber extensibility as a measure of tenderness were studied. The data obtained from the 75 carcasses used in this project warranted the following conclusions:

There were differences in color of the *Longissimus dorsi* between the three finish groups. As the degree of finish increased, the hue shifted to a more yellow red range and lightness increased. Highly significant differences were found for cure loss of bacons. Ham cure loss decreased as fatness increased, but the differences were not significant. The difference in defrosting drip loss of the loin chops was highly significant, as finish increased, drip decreased. The mean values of the Boston butts and loin roasts indicated

TABLE 7

Analysis of variance of total cooking loss of various cuts, specific gravity and chemical analysis

Source	d.f.	Deep fat fried		Roasted			Sp. Gr. of *L. dorsi*	Chemical analysis	
		8–9th rib chop M.S.	2nd lumbar loin chop M.S.	2nd lumbar loin chop M.S.	Ham M.S.	Bacon M.S.	M.S.	Ether extract M.S.	Moisture M.S.
Total	74								
Finish	2	3.95	9.85	4.37	10.14	64.40*	.0003**	77.01**	22.57*
Error	72	12.93	6.00	5.86	5.41	17.14	.0000375	10.26	4.64

* P<.05.
** P<.01.

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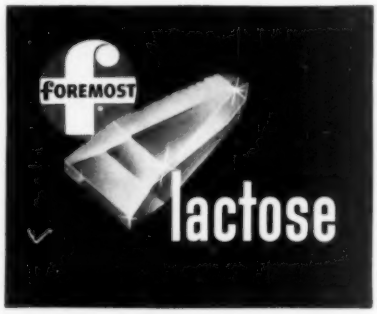

that percentages of defrosting drip loss were inversely related to the degree of finish, but were not statistically significant. No significant differences were found for total cooking loss regardless of the cut of meat used or method of cooking with the exception of bacon cooking loss, which was significant between the different finish groups.

High correlation coefficients between specific gravity and both per cent fat and per cent moisture of the *Longissimus dorsi* indicated that specific gravity may be used as an objective measurement of marbling. The estimating equations for per cent fat and per cent moisture were $Y = 469.38 - 434.42X$ and $Y = -186.88 + 241.65X$, respectively, when X is specific gravity in both equations.

Highly significant differences were found for taste panel scores of the loin chops between the finish groups, but no significant differences were found for either the hams or bacons. Low but highly significant correlations were found between taste panel scores of the loin chops and the following: specific gravity, ether extract, shear and muscle fiber extensibility. Low but highly significant correlations were also found between muscle fiber extensibility and both shear and marbling.

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Notes and Letters

On the Reading of Annual Meeting Papers

Editor, Food Technology

Dear Sir:

I read with interest the letter by Mr. Frey in the November issue of Food Technology on the reading of papers at meetings. This is a point I have been harping on for years and I am pleased to see that other people are becoming concerned. However, I would not say that most of the fault lies with junior authors. Personally, I should like to see junior authors encouraged to give more of the papers. These younger people bring along new ideas, and they should be given complete freedom for expression. The fault as I see it lies squarely on the shoulders of the Institute and the chairmen chosen to head up the various sections. If it is made known in advance that reading of papers is not permitted and if this rule is rigidly enforced by the chairman I believe this whole problem would be solved very quickly.

There is a decided tendency on the part of many authors to go beyond their allotted time in the presentation of material. Not only does the audience become bored but authors of papers following suffer. This problem, too, is one for the chairman to tackle. It has always been my opinion that an author who has been closely associated with a research project should be able to bring out the highlights of the work in a period of 10 minutes; presenting material in such a way that it is going to stimulate discussion. If this can't be done then the author should not present the paper at all. If the allotted time is 15 minutes then 5 minutes remain for discussion. I believe most people will agree that the discussion following presentation is probably just as important or of even greater importance than the paper itself.

I agree with Mr. Frey on the presentation of data on slides. These slides form an important part of papers and greater use should be made of visual presentation. A graph or a table which is not too complicated can often serve to put an idea across which could not be satisfactorily presented in the text of the presentation.

These criticisms are not confined to annual meetings of the IFT; the remarks are equally applicable to many other associations. I have sat for years at meetings listening to papers being presented and at times have been extremely bored. I recall one particular paper which I have now heard for the fifth time. True, the title and some parts of the text were changed but the end result was always the same. More care might be exercised by the chairmen of sections to make certain that the presentation of material is not being overdone by some authors. If the material has been presented at other meetings and published it would seem to me that further presentation should be avoided unless the author has something definitely new to bring before his audience.

The thoughts expressed in this letter are those of the writer. I always enjoy attending meetings of the IFT. Over the years from the first meeting I attended in 1939 there has been a noticeable general improvement in the presentation of papers. The idea of prizes for the best presentation of papers was a good one and should be continued. However, not all of us are outstanding public speakers and this idea might be enlarged upon with the presentation of certificates if in the opinion of the chairmen a paper was well presented. This might stimulate authors who have not done a satisfactory job one year to improve their technique the following year. I don't believe anyone would want to continue giving papers year after year if they were not of interest to their audience.

Well, as Mr. Frey has stated, these are just suggestions. I would like to see a great deal more discussion on this subject. The aim should be to make the IFT meetings as interesting as possible.

Yours very truly,

A. H. Jones
Senior Bacteriologist
Canada Department of Agriculture
Ottawa, Canada

November 13, 1958.

The Editor, Food Technology

Dear Sir:

I have read with misgivings the summary report of the Educational Conference held last May to determine a curriculum for the four-year student preparing for work in the food industry (Food Technology, September, 1958). I am happy to see that the report is titled, "What *training* should a four-year food technology student receive?," for attention is directed to *training* rather than *education*. Somewhere, in reading the addresses of leading American industrialists, I gained the impression that there is a demand in industry for college graduates who are educated, that is, have not only a partially developed competency in a major field but also have some experience in the broad areas of human culture and some ability to think clearly about a variety of problems, including those which are not directly concerned with earning a living. Possibly I misread these remarks or possibly the food industry only needs trained graduates.

I can sympathize with those employers who want to hire a man trained for the vacant position but cannot help wondering if they might not derive greater benefits from an educated person who has the adaptability to absorb necessary techniques while on the job. Imagination, insight, and understanding are qualities much sought in modern industry. These virtues, along with clear thinking and lucid expression, are hardly likely to be developed in the model curriculum limited to one year of English, a single course combining speech and report writing, three credits of economics, and twelve elective credits in humanities and the social sciences combined! Acquisition of a reading knowledge in a modern language will swallow the elective credits in one gulp. If there is no interest in language, the twelve credits may be spread out between literature, philosophy, art, music, anthropology, sociology, political science, history, psychology, religion, or more composition, speech, and economics. It may be argued that the food technologist has the rest of his lifetime to read about these subjects. It is unlikely that he will if an interest has not been created during the years of formal education.

Makers of professional curricula seem to be guilty of assuming that the graduate cannot learn anything professional after he leaves school. Is it not time for us to begin thinking of the undergraduate years as the time to educate the student in the basic sciences, the humanities, and the social studies. If this leaves gaps in his training I am of the opinion that he will now have the ability to fill them by self-study, on-the-job training, or graduate study.

The statement is made that while the model curriculum comes to 131 hours, most schools have available approximately 144 hours so there is additional room for electives. My own university requires 124 hours of the four-year graduate, which is even short of the model curriculum. While it is true that some technical courses require more than 150 hours, these courses have never been noted for the amount of freedom they permit for election of courses outside the professional field. I would guess that food technology training courses having 144 credits at their disposal will end up with the additional credits used up with how-to-do-it courses.

Yours sincerely,

Aaron Ihde
Professor of Chemistry
The University of Wisconsin
Madison

(Continued from page 23 preceding technical section)

C.I.F.T. Conference to be Held June 11 & 12, Royal Oak Hotel, Toronto

Theme of the 1959 C.I.F.T. convention is "Food Research in Canada." Food technologists from all provinces will hear first-hand reports from the men across Canada who are today carrying out the work which will shape the future of the industry. Outstanding experts in the field will tell of the newest advances in irradiation, antibiotic preservation of foods, developments in fats and oils, the future for convenience foods, packaging progress, nutritional discoveries and the bacteriology of frozen foods.

The conference will be held on June 11 & 12 at the Royal York Hotel, Toronto. Full details are available from: Mr. J. S. Wenzel, Griffith Laboratories Ltd., 115 George Street, Toronto.

A full program for the ladies has also been arranged. It will ensure that they have an interesting and entertaining two days while the technical sessions are in progress.

Climax of the conference will be a very special banquet, currently being planned. The food industry is in a unique position to produce a historic menu which will be long remembered. More details on this and other conference highlights will be sent in future releases.

IFT NEWS

REGIONAL NEWS

CHICAGO

Ac'cent International, a division of International Minerals and Chemical Corporation was host to the Section in February. A tour of the buildings began at 4:30 p.m. and those who participated, some 300 IFT'ers and friends found them to be equal in every respect to their reputation. Research facilities are of the finest, the design of the interior—laboratories, offices, and conference rooms—being truly superb. As one detail among many, the room where the "flavor profile" of a food in delineated has a large round table equipped with a built-in lazy susan.

The motion picture of International's far-flung industrial activities was extremely well done, the wide screen and the excellent color photography giving an on-the-spot impression of how modern, mechanized mining and manufacturing operate to meet the needs of the world.

After dinner in the huge, handsomely decorated dining room, Dean Howard of the University of Illinois presented a fine address on the "Flavor of Food Technology." He recounted some of the advances made in measuring flavor and spoke of the challenges of the future in this and other aspects of food technology. Ray Wakefield, IFT president-elect, presented the Gerber Award to Mr. Kenneth Leberman, University of Illinois student, recipient of the scholarship.

NORTHEAST

The January meeting of the NE Section, which was new members' night, was highlighted by a visit from Ray Wakefield who came riding in on the shoulders of a blizzard. As the representative of the Gerber Baby Foods Scholarship Fund he presented three awards to students in this area: a renewal to Yorkette Soloman of the University of Massachusetts; new awards to Robert P. Bates and Norman Bednareyk of Massachusetts Institute of Technology. Bernie Proctor, Head of the Food Technology Department, M.I.T., assisted in presenting plaques to his students. As President-Elect, Ray briefed the group on some of the national activities, and as Director of Research and Quality Control of Gerber Products Company he spoke interestingly and to the point on "Horizons in the Food Industry."

At the February meeting, the membership obtained practical information on aerosol products from Robert C. Webster, Manager of Customer Service Packaging Laboratory, of the Air Reduction Company. Whipped cream, barbecue sprays, chocolate syrups, meat tenderizers and soft drink concentrates trace the developmental history of pressurized foods. They exemplify fulfillment of prerequisites to pressurized food products which are: (1) convenience; (2) utility; and (3) relatively high cost items that can absorb the extra cost of packaging. The key to successful development is to build the product to the aerosol package.

Jean F. Caul

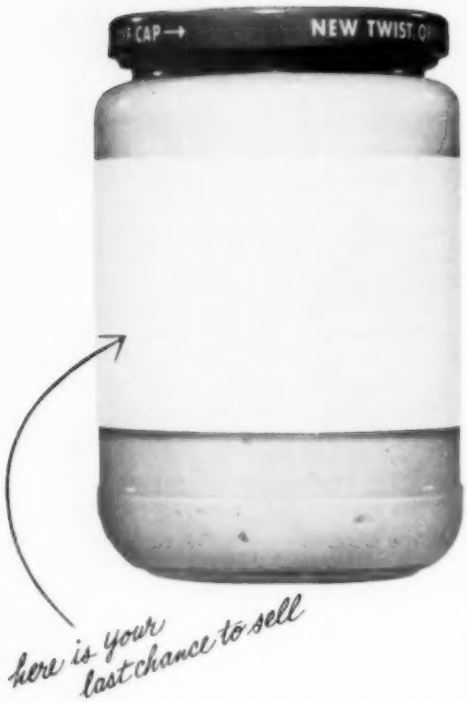
GREAT LAKES

Sixty members and guests of the Great Lakes Section, Institute of Food Technologists braved the worst blizzard of the year to attend the winter meeting of the Great Lakes Section, Institute of Food Technologists held at the University of Michigan, Ann Arbor, Michigan, January 23, 1959. The technical session was held in the morning and consisted of several papers discussing the application of nuclear or atomic energy to food preservation and processing. Listed below are the speakers for the morning technical session:

10:00 Welcoming adress:
Ralph A. Sawyer, Ph.D., ScD, LLD, Dean of the Horace H. Rackham School of Graduate Studies and Director of the Michigan Memorial-Phoenix Project.

10:30 "Experiment Design Considerations in Gamma Irradiation of Food" Lloyd E. Brownell, Ph.D., Professor of Chemical & Metallurgical and of Nuclear Engineering. Director of Fission Products Laboratory.

11:00 Summary of Animal Feeding Experiments at Fission Products Laboratory." Charles H. Burns, Ph.D., Research Associate, UMRI.



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11:30 "Bacteriological Aspects of the Food Research Program" Lloyd L. Kempe Ph.D., Professor of Chemical and Metallurgical Engineering & Professor of Bacteriology.

Following lunch at the Women's League, Dr. Leatherman, Assistant to the director of the Michigan Memorial Phoenix Project discussed the broad scope of the Phoenix Project at the University of Michigan. This was a very interesting and informative presentation.

Following the luncheon the group was taken on a tour of the Memorial Phoenix Laboratory where the group was able to visit the nuclear reactor and other laboratory facilities for experimenting with and developing peaceful uses of atomic energy.

This was a very worthwhile meeting and all of the members came away from the meeting with a greater appreciation of the importance and many uses of atomic energy and radioactive tracers in food research.

I. J. Pflug

MARYLAND

MIFTS held their first meeting of 1959 in the Maryland State Board of Health Auditorium in Baltimore on January 16th. Dr. Robert C. Wiley of the University of Maryland presented a paper entitled "The Processing of Apples and Apple Products in the Eastern United States." His talk included key points in apple statistics and background information; field and plant production problems; and slice, sauce and hot-pack pie filling research.

An important development in production research at Maryland has shown that borate sprays at full bloom have greatly reduced the incidence of bitter pit and internal cork in apples. Dr. Wiley indicated that control of this problem will save processors of apples thousands of dollars in trimming and improve the overall quality of the product. Maturity measurements in the orchard and on incoming-loads were shown to be difficult. His discussion indicated that no one test on the raw product is suitable to predict slice or sauce quality but that the use of 2, 3, or 4 tests in a multiple relationship showed considerable promise. Unfortunately, quality predictors such as color of flesh, firmness, acidity, solids, etc., vary in importance among varieties.

Further discussion with pictures and slides featured the new apple grades developed at V. P. I., recent developments in automatic peeling, relative importance of apple slice and sauce quality factors, consistency-syneresis-yields relationships in sauce, and problems in hot-pack pie fillings. A most interesting question and answer period followed his talk.

At the February meeting, Mr. Richard E. Williams of the Food and Drug Administration presented a most informative talk on "The New Food Additives Law." His talk traced the history and development of the present Federal Food Law, the basis for the new food additives ammendment, and the responsibility of the producer to prove the safety of food additives. A very interesting question and answer period followed.

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	Type 18-00	Type 18-07	Type 18-40	Type 18-85
Source material	Fully hydrogenated lard	Fully hydrogenated cottonseed oil	Prime steam lard	Refined cottonseed oil
Monoester content (min.)	90.0%	90.0%	90.0%	90.0%
Saponification value	155-165	155-165	160-165	150-160
Iodine value	1	1.0 (max.)	45 (approx.)	80-90
Glycerol content (max.)	1.0%	1.0%	1.0%	1.0%
F.F.A. (max.): as stearic / as oleic	1.5%	1.0%	1.5%	1.5%
Specific gravity	0.96 at 75°C	0.94 at 75°C	0.96 at 60°C	0.96 at 60°C
Congeal point (approx.)	68°C	67°C	54°C	46°C
Clear point (approx.)	73°C	76°C	60°C	56°C
Form	Bead	Bead	Plastic homogenized fat	Plastic homogenized fat
Net shipping weight, lb.	250	250	400	400

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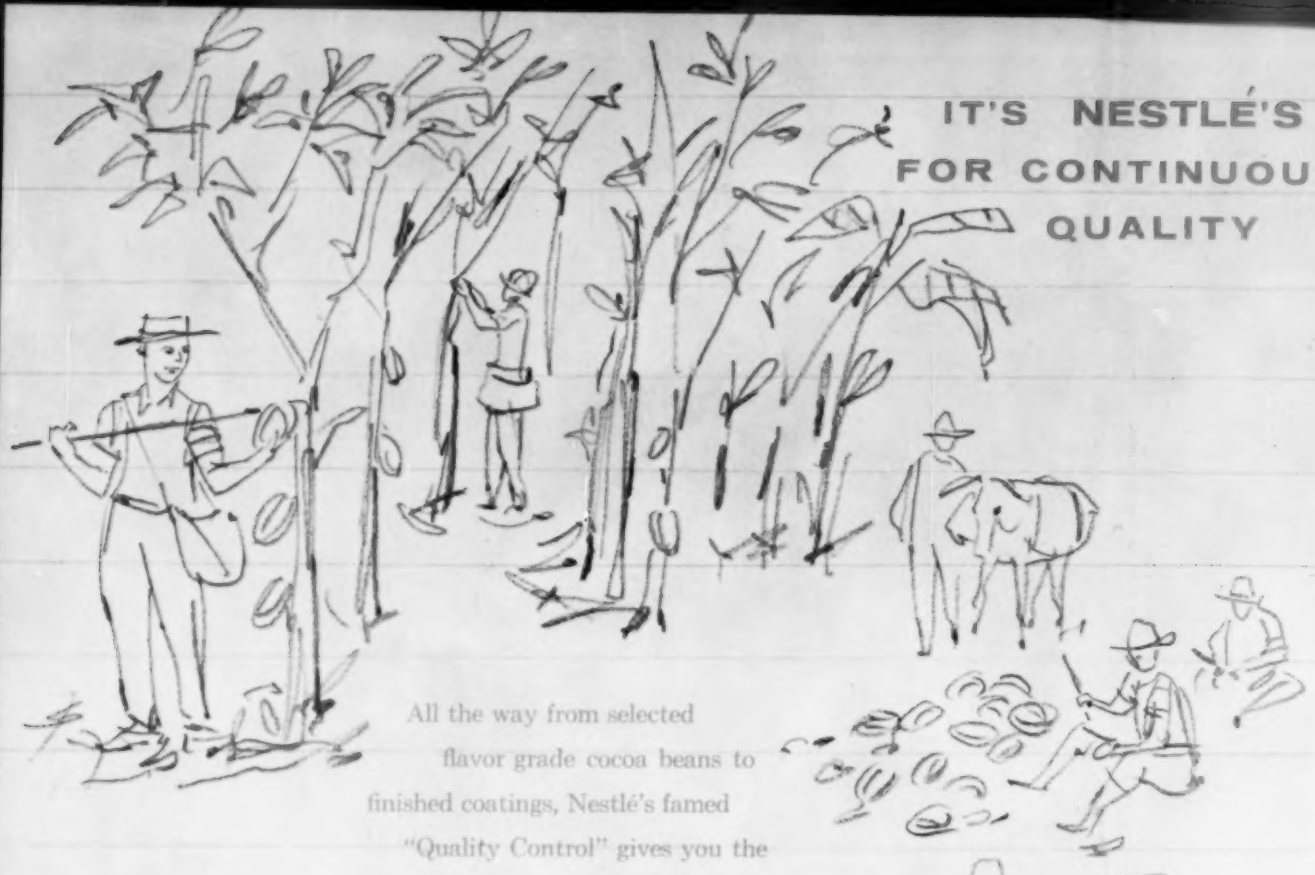

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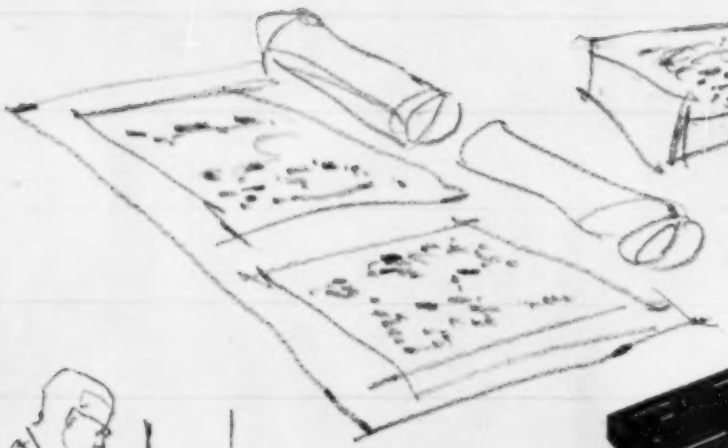

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BRITISH COLUMBIA

Seventy-six members and guests of the B.C. Food Technologists and the B.C. Section I.F.T. met in the Astor Hotel in Burnaby on Thursday, February 5 for their annual dinner meeting. A number of out-of-town members, in Vancouver to attend the annual meeting of the Western Food Processors Association, were in attendance.

Chairman Charles Bullen introduced the guest speaker, the previous Minister of Fisheries, now the President of the B.C. Fisheries Association, Mr. James Sinclair, who spoke on "Fish Versus Power." Mr. Sinclair immediately corrected our error in title, and said that he perferred to speak on "Fish and Power," as he felt that both of these resources could be had if proper management were used.

"In view of tendencies to be profligate with our resources while ⅓ of the world goes to bed hungry, the conservation of all our natural resources demands top priority," the speaker stated.

After outlining the life cycle of the salmon, he discussed some of the problems associated with getting as many as 750,000 adult salmon a day over a high power dam, and in getting the fingerlings down again. About 200 fingerlings must reach the sea for each adult salmon expected to return. Present research on ladders, elevators, diversion techniques, hatcheries and other techniques show some promise, but as yet do not provide a satisfactory answer so far as the fisheries people are concerned. When a salmon run appears in the Upper Columbia River, these techniques will have proven their usefulness. In the meantime, why gamble when adequate power can be produced on non-salmon tributaries of the Fraser River and on the Columbia and Peace Rivers? The major power spokesmen are presently accepting this attitude, and estimate these sources will provide sufficient power until 1975. At that date, other sources of power may well be competitive with hydroelectricity.

At the February meeting, left to right, rear row, are Mr. F. E. (Ted) Atkinson and Mr. Charles Bullen, chairman, B.C. Food Technologists and B.C. Section IFT; front row, Dean B. A. Eagles and Mr. James Sinclair, guest speaker.

WASHINGTON, D. C.

The February meeting was held in the National Canners' Association Building. After a short business meeting, the membership was privileged to hear two speakers from the Bureau of Marine Fisheries, Department of Interior. The first speaker, Mr. H. L. Moore, Assistant Chief, Branch of Marine Fisheries' Division of Biological Research, emphasized the role of biological research in maintaining a sustained food and industrial product yield from the Nation's fishery resources. This is a modern, practical definition of the word "Conservation." Biological research involves the gathering of information concerning the numerous fish species, their needs and life cycles and the numerous factors of oceanography which affect the production of the fishery concerned. This information is absolutely in management of the resource, according to the speaker.

The second speaker, Mr. Charles M. Butler, Coordinator of the Saltonstall-Kennedy program of the Division of Industrial Research and Services spoke on research concerning the use of the fishery resource as food or industrial products. Much of the present program concerns the chemistry of fish oils which greatly affects their usage in margarines, insecticides, tanning, etc. A striking example of the effect of oceanic climate on the iodine number of the oil of one of the industrial fish species was given. Research, now being carried out under this program, is expected to aid the fisheries industries in recovering their former industrial markets.

A. P. Sidwell

AK-SAR-BEN

We had an interesting development at the last meeting of the Ak-Sar-Ben Section of the Institute of Food Technologists. It could perhaps be entitled "What To Do When The Speaker Does Not Arrive." We had arranged for our January meeting to have Mr. Larry Heid, who is now in Cedar Rapids, Iowa with Cherry-Burrell, address our meeting in Omaha on the subject of "New Developments in Food Processing Equipment." Our meeting was the usual dinner meeting and was arranged for January 14th. In the afternoon of the 14th we learned from Larry that he was weather-bound in Cedar Rapids and could not get to Omaha. I need not say that there was somewhat of a busy scramble because we have people traveling some distance and did not want to cancel our meeting. We recognized that we had several logical courses if we were going to hold our meeting. To be sure that we had something, we arranged to have a couple of movies, which we incidentally obtained from the Union Pacific headquarters. When it was definite that Larry could not get here, we had two logical alternatives. One was to change the subject and look for a speaker with a ready-made speech in the files, or to try to keep our subject and perhaps in that way be more acceptable to the expected audience.

We decided to keep our subject although we did extend it somewhat in scope. Five of our members

with anticipated speaking ability and prominent experience in different phases of local food industry or activity were contacted and agreed to address themselves to their version of the subject for about a 5 to 10 minute talk. For example, Bill Phalen, of the Cudahy Company, discussed "The Most Significant Recent Technical Advances in Meat Packing"; Walter Wood, Ocoma Foods, covered "The Most Significant Recent Technical Advances in Frozen Prepared Foods"; John Meader, Continental Can Company, covered "The Most Recent Advances in Food Packaging"; Dr. Bert Maxy, recently of the Diversey Company, and now on the University of Nebraska staff, covered "Food Sanitation Advances from the Equipment Viewpoint"; and finally, Dr. Feeney addressed himself to the subject of the role of biochemistry in all of these changes. Throughout these discussions we attempted to show how advances in one field can be and are adapted to another.

Although all credit goes to our speakers who did so well on such short notice, this meeting was rated as one of our best. Incidentally, since we had the movies on hand we put on the equivalent of a "late, late" movie, after the meeting was formally adjourned.

Robert P. Joslin

S. CALIFORNIA

The Southern California Section of the Institute of Food Technologists held its regular meeting on Wednesday, February 18th, 1959, at the Roger Young Auditorium in Los Angeles. An interesting and enlightening talk by Dr. B. H. Ershoff, director of the Western Biological Laboratories of Culver City, California, titled "Unidentified Nutritional Factors and Resistance to Stress," highlighted the evening. Dr. Ershoff, a member of the local section, received his Ph.D. degree at the University of California at Berkeley, in Animal Nutrition. In addition to his association with the Western Biological Laboratories he is also Visiting Professor of Biochemistry and Nutrition at the University of Southern California. In his talk Dr. Ershoff presented evidence for the existence of unidentified nutritional factors, present in natural foodstuffs that are essential for optimum adaptation and resistance to various stressor agents. A series of well chosen slides vividly illustrated the effect of these unidentified factors on various experimental animals.

—E. Kyle Bacon

N. CALIFORNIA

Two highlights of the informative annual all-day meeting and evening program in December were the Awards and New Officers Slate for 1959.

Miss Joan Rae Clark received the W. V. Cruess Award with its financial stipend. The General Foods Fellowship was awarded to Mr. Harry Snyder. Both recipients are in Food Technology at the University of California, Davis, California. The Man of the Year Award was presented to Norman E. Liles, Quality Control manager, Tri-Valley Packing Association, San Jose.

Officers for 1959 are: Bruno A. Filice, Chairman; Charles T. Townsend, Vice Chairman; Dave Eolkin, Executive Secretary; Robert B. Baylor, Membership Secretary; and Robert W. Johnson, Treasurer.

At the Claremont Hotel in Berkeley, January 15, the Northern California Section, Inc., held a joint meeting with the Nutrition Foundation, Inc., the latter group being hosts. Dr. Horace L. Sipple, Executive Secretary, The Nutrition Foundation, Inc., New York, presided at the noon and dinner sessions. Bruno A. Filice, Chairman of our section, presided at the afternoon session.

Dr. James W. Evans spoke to us on "New Developments in Corn Syrup Technology and Their Application in Food Processing" at the February 12 meeting at the Red Chimney Restaurant in San Francisco. He is well versed on his subject for, as Director of Research for American Maize-Products Company, he has 26 years experience, specializing in starch and corn syrup research.

Of the 20% total corn crop that goes to market, American Maize uses 4% of it. *Types* of corn syrups are: Low Conversion—30–37% D.E.; Regular Conversion—38–49% D.E.; Intermediate Conversion—50–57% D.E.; High Conversion—58% D.E. and higher.

Corn syrup is a viscous, sticky, colorless material. Corn Syrup Solids is dried corn syrup. It has wide usage, in all D.E. ranges, the majority at 42 D.E.

The *chemical properties* of corn syrup include: reducing powers, fermentability (beer and lactic acid); a portion combines with nitrogenous compounds at elevated temperatures to produce brown coloration (caramel crust color of bread and cake and caramel flavor); subject to alkaline degradation (not important in the food industry).

Corn syrups *physical properties* include: solubility; hygroscopic; osmotic pressure; no melting point; adhesive (sticky); inhibits crystallization; viscosity (D.E.) of sugars and other items; glossy appearance.

Newer *uses* of corn syrups (in the past 5 or 6 years): fruit canning; catsup; applesauce (50% sugar as corn syrup); canned and frozen sweet potatoes; fruit pie fillings (syrup with starch); dried and frozen fruits (dip, coat, spray—adds to desirability); fish glazing; table ready meats (no casing on cold cuts and franks); packed frostings and bakery mixes (29 D.E.); instant puddings (used in pre-cook of starch).

At the Beef 'N Bird, San Francisco, on March 12, there was a special meeting. Mr. Ray B. Wakefield, President-Elect of the Institute of Food Technologists, spoke on "Horizons in the Food Industry." Mr. Wakefield is Director of Research at Gerber Products Company, Fremont, Michigan.

"San Francisco—1960" is the locale for the 20th Annual Convention of the Institute of Food Technologists May 15–19 at the Fairmont Hotel and Masonic Temple, both atop Nob Hill.

—Shirley V. Noland

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Literature

BOOKS

PROCESSED PLANT PROTEIN FOODSTUFFS. A. M. Altschul, Editor. Academic Press Inc., New York, 1958. 955 pages.

This text covers in detail the sources, production and processing of plant protein foodstuffs and how and why they are used for animals and man. The subject is discussed in thirty-three chapters, authored by various authorities in the field.

In the first few chapters the reader is informed of the objectives of this work and then is given a brief but effective discussion of what protein is and its significance in animal and human nutrition. This is followed by a concise discussion of the general properties of plant proteins, their sources and composition.

This general background material continues with coverage of the general properties and uses of plant proteins including, among other topics, the effect of heat and other processing factors on plant proteins, evaluation of protein quality and the supplementation of plant proteins with amino acids.

In the remainder of the book, specific plant proteins are discussed in greater detail. It would be most difficult to give here a complete list of all of the proteins discussed. Some of the major ones include soybean, cottonseed, seasame, linseed, coconut and alfalfa. There is also an interesting brief chapter on the algae, which may be indicated as a means of feeding during space travel.

The book is recommended as an excellent reference work for those persons interested in plant proteins whether as nutritionists, growers, processors or users.

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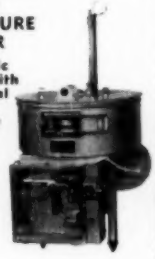
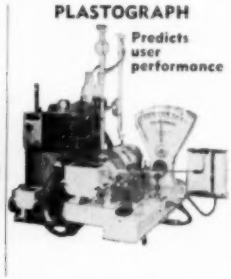


PLASTOGRAPH



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LITERATURE ON FOOD RESEARCH AND FOOD TECHNOLOGY[a]

Food Technology

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[*Technology of the salting, smoking, and drying of fish.*] Teknologiia posola, kopcheniia i sushki ryby. Izd, 2, peres i dop. N. A. Voskresenskii. Moscow, Gos. Nauchno-techn. izd-vo. Mashinostroit. Lit-ry, 1958. 117 p. In Russian.

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[a] Material for this list should be sent to Dr. James G. Hodgson, Chief, Library Branch, Quartermaster Food and Container Institute for the Armed Forces, 1819 W. Pershing Road, Chicago 9, Illinois.

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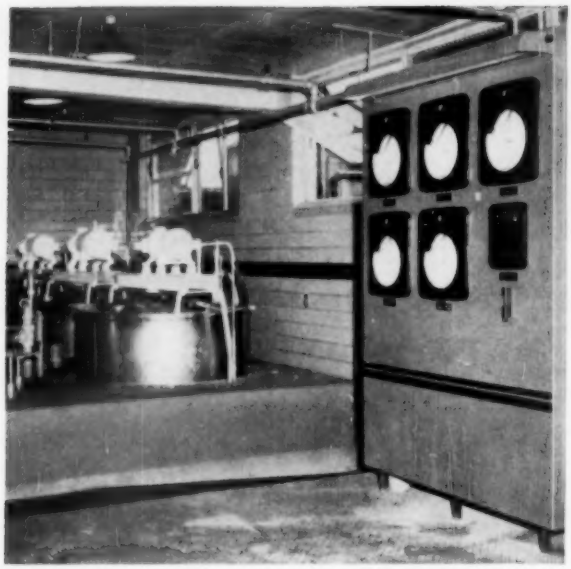

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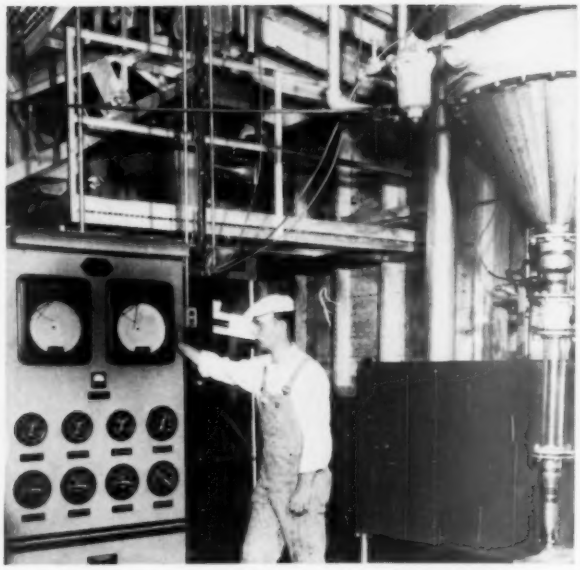

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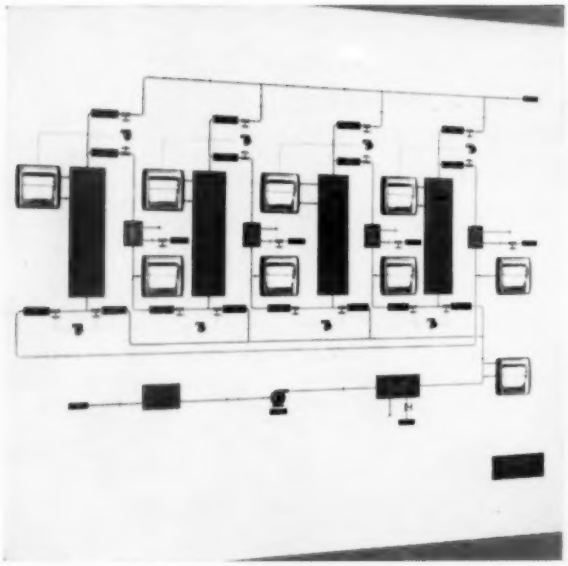

COFFEE PROCESSOR – NEW YORK This centralized control panel has its graphic diagram painted on a formica plastic background, permitting **easy** modification of the diagram should process changes occur. **Painted formica panels** are only one of several types of graphic control panels available from Foxboro.

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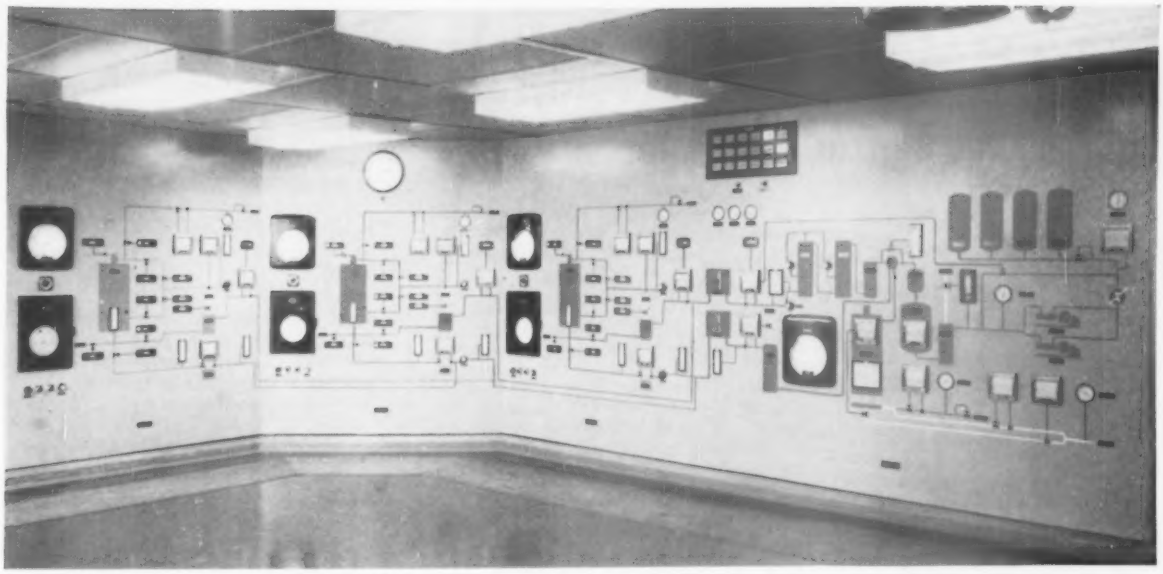

VEGETABLE OIL REFINERY – ILLINOIS Complete control of hydrogen generation units is accomplished from this graphic panel. Small-case Consotrol* Recording-Control Stations are installed right in the process diagram — linked to their appropriate measurement and control points by colored lines — resulting in easier operation and better process supervision. **All back-of-panel connections** are plainly marked for quick and easy identification.

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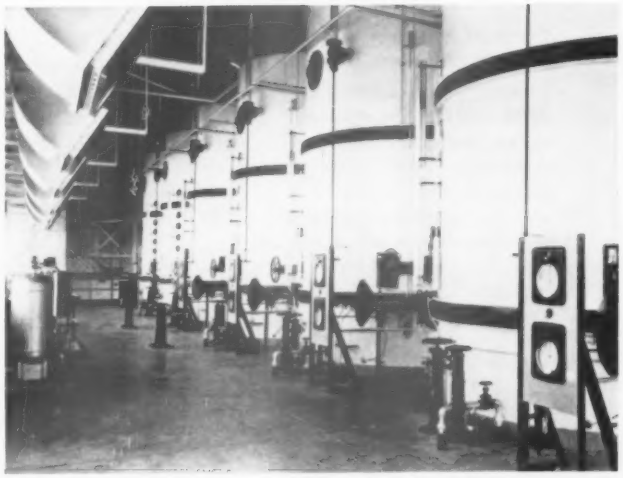

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Radiation

[*Radiobiology; Biological effect of ionizing radiation.*] Radiobologiia; Biologicheskoe deistvie ioniziruiuschego izlusheniia. D. E. Grodzenskii. Moscow, Izd.-vo. "Znanie," 1958. 31 p. (Vsesoiuxnoe obshchestvo po rasprostraveniiu politicheskih i nauchnykh zranii. Ser. 8, syp. 1, no. 17.) In Russian.

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[*Overtake and surpass the U.S.A. in the output of livestock products.*] Dognat' i peregnat' SShA po proizvodstvu produktov zhivotnovodstva. Moscow, Gos. izd-vo sel'khoz. lit-ry, 1958. 469 p. In Russian. One of many fairly similar titles for other activities.

[*Planning public eating establishments.*] Proektirovanie predpriiatii obshchestvennogo pitaniia. V. I. Khrenov. Moscow, Gos. izd-vo torg. lit'ry, 1958. 271 p. In Russian.

Use of blood meal in livestock feeds. O. G. Rasmussen and others. Chicago, 1958. 15 p. (American Meat Institute Foundation. Bulletin no. 39.) pap. apply.

Bacterial food poisoning and its control —a review. W. B. Esselen and A. S. Levine. Bull. 493, College of Agriculture, U. Massachusetts, Amherst. Single copies *gratis*, additional copies, 10 cents.

ABSTRACTS

—Compiled by H. A. Campbell

ANALYTICAL METHODS

Gas-liquid partition chromatography. Determination of 2, 6-di-tertbutyl-p-cresol on antioxidant treated paper board.

JENNINGS, E. C., CURRAN, T. D. AND EDWARDS, D. G. (Fibreboard Paper Products Corp., Antioch, Calif.). *Anal. Chem. 30*, 1946–50 (1958).

The antioxidant, 2, 6-di-*tert*-butyl-*p*-cresol, content of treated paperboard is detd. by extn. with cyclohexaneisopropyl alc. and concn. prior to gas-liquid partition chromatography. Over a concn. range of 14.4–144 mg./ft. recoveries of 100 ± 10% were obtained. Retention time may be used for the identification of antioxidants and masking compds.

BIOLOGICAL SCIENCES

Biochemistry

Glucosamine and biosynthesis of serine.

MUNCIO, A. M. AND MALLOL, M. (Inst. di Quimica, Serrano 119, Madrid). *Intern. Congr. Biochem. 4*, 152 (1958).

In order to det. whether serine may be formed from glucosamine by a series of reactions involving the retention of the nitrogen, (1-^{14}C)glucosamine has been injected in rats. The administration of (1-^{14}C)glucosamine took place under different conditions and afterwards proteins from organs and tissues were collected the usual way. Glycine, serine, alanine and glutamic acid were isolated from protein hydrolysates. In no case could radioactivity be detected in these amino acids. Much of the injected ^{14}C is found in the urine.

Thermal copolymerization of amino acids to a product resembling protein.

FOX, S. W. AND HARADA, K. (Chem. Dept., Florida State Univ., Tallahassee). *Science 128*, 1214 (1958).

A proteinoid was synthesized from glutamic and aspartic acids, glycine, alanine, and leucine. The polypeptide nature of the polymer was demonstrated by chromatography and substantiated by biuret tests and infrared analyses.

Aerobic transformation of cysteine to sulfate in soil.

FRENEY, J. R. (Div. of Plant Industry, C.S.I.R.O., New South Wales, Australia). *Nature 182*, 1318–19 (1958).

The results obtained here indicate the transformation of cysteine to sulfate in the soil follows the sequence: cysteine→cystine→cystine disulfoxide→cysteine sulfenic acid→sulfate. Although cysteine sulfenic acid had been suggested as an intermediate in the production of sulfate in animal metabolism, this system would be derived from cystine disulfoxide and not directly from cysteine.

The biosynthesis from acetate-1-C^{14} of fatty acids and cholesterol in formed elements.

O'CONNELL, V., OTTOLENGHI, P., MALKIN, A., et al. (Dept. of Biochem., McGill Univ., Montreal, Can.). *Can. J. Biochem. Physiol. 36*, 1125–36 (1958).

The biogenesis, *in vitro*, of cholesterol and fatty acids from acetate-1-C^{14} in the cellular elements of blood has been studied. From the results obtained it is apparent that whereas the normocytes (nucleated) from the chicken and from the mammal (nonnucleated) are devoid of the capacity to synthesize cholesterol and fatty acids, the reticulocytes and the normoblasts from the rabbit, with an experimentally produced reticulocytosis, possess the ability to synthesize these lipids. Studies on the leucocytes from normal mammalian blood and thymus tissue showed little or no activity. On the other hand, the leucocytes from the thymus tissue and blood of chickens and from the blood of a patient with chronic myelocytic leukemia and from another with monocytic leukemia (Naegeli type) were capable of utilizing C^{14}-acetate for the synthesis of lipids. The leucocytes from patients with chronic lymphatic leukemia were found to be devoid of this activity.

Hydrolysis of mercuripapain by leucine aminopeptidase without loss of enzymic activity.

HILL, R. L. AND SMITH, E. L. (Dept. of Biol. Chem., Univ. of Utah School of Med., Salt Lake City). *J. Biol. Chem. 231*, 117–33 (1958).

The *N*-terminal portion of mercuripapain is extensively degraded by leucine aminopeptidase (LAP), the extent of degradation depending upon the ratio of LAP to the substrate. Although about ½ to ⅔ of the 180 residues of mercuripapain can be removed, there is no loss in the proteolytic activity of the degraded mercuripapain after reactivation with cysteine and Versene. Thus, the active site of papain must reside in the *C*-terminal portion of the enzyme.

On the mechanism of enzyme action. LXVII. Acetylation of trypsin in organic solvents.

VRATSANOS, S. M., BIER, M. AND NORD, F. F. (Dept. of Org. Chem., Fordham Univ., New York City). *Arch. Biochem. Biophys. 77*, 216–26 (1958).

Reactions of trypsin were investigated in formamide and dimethyl sulfoxide solns. The sensitivity to basic conditions of the enzyme dissolved in these solvents was illustrated, and conditions were established for retaining the enzymic activity at high levels. Acetic anhydride was proved to function as a strong inhibitory agent in formamide or dimethyl sulfoxide solns., strikingly deviating from its behavior in aq. solns. of trypsin.

Chemistry of the vitamin B_{12} group. VII. The products of chromic acid oxidation.

CLARK, V. M., JOHNSON, A. W., SUTHERLAND, I. O. AND TODD, A. (Univ. Chem. Lab., Cambridge, Engl.). *J. Chem. Soc.* 3283–9 (1958).

Chromic acid oxidation of dehydrovitamin B_{12} and the hexacarboxylic acid but not of vitamin B_{12} or its acid degradation products, yields a new imidelactam. The isolation of this product confirms the presence of an extra ring both in dehydrovitamin B_{12} and in the products of vigorous alk. hydrolysis of the vitamin.

Effects of 3-acetylpyridine on metabolism of nicotinic acid in rats.

GUGGENHEIM, K. AND DIAMANT, E. J. (Hadassah Med. School, Jerusalem, Israel). *Biochem. J. 69*, 56–9 (1958).

Rats treated with 3-acetylpyridine excrete more N^1-methylnicotinamide-like substances in their urine than do untreated controls. Repeated small doses or one single dose of 3-acetylpyridine lead to a lower excretion of these substances than that observed after administration of corresponding doses of nicotinamide. Small doses of 3-acetylpyridine promote the growth of rats maintained on a corn-sucrose diet, whereas large doses depress it. Supplementation of this diet with liberal amts. of nicotinic acid has no significant ameliorating effect on this inhibition of growth.

Microbiology

Preservation of microorganisms by freeze-drying. I. Cell supernatant, Naylor-Smith solution, and salts of various acids as stabilizers for Serratia marcescens.

BENEDICT, R. G., CORMAN, J., SHARPE, E. S., et al. (Northern Utilization Research and Devel. Div., Peoria, Ill.). *Appl. Microbiol. 6*, 401–7 (1958).

A carefully standardized procedure for preparing and drying cells of *Serratia marcescens* was developed in this study. Cells harvested from skim milk protopeptone glucose medium after 22 hr. growth showed an unusually high initial survival when dried in their own supernatant culture liquor. Tests of the sodium salts of various acids in a range of concn. showed that the max. drying protection/200 x 10^9 cells/ml. was generally afforded at stabilizer levels between 0.05 and 0.1 *M*.

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Torula yeast as a dietary supplement. Study in acceptability by patients.

KLAPKA, M. R., DUBY, G. A. AND PAVCEK, P. L. (Winnebago State Hosp., Winnebago, Wisc.). *J. Am. Dietetic Assoc. 34*, 1317–20 (1958).

The feeding of Torula yeast in various foods was tested at Winnebago State Hosp., Wisconsin. Acceptability of the yeast-contg. foods varied, but in general favorable reactions were recorded. Soups, meat casseroles, chili, gravies, tomato sauces, and vegetable dishes were especially well received. The addn. of yeast to foods may be considered a practical way to increase protein in the diet.

Chromatography of tobacco mosaic virus and potato virus X.

LEVIN, O. (Inst. of Biochem., Univ. of Uppsala, Sweden). *Arch. Biochem. Biophys. 78*, 33–45 (1958).

Tobacco mosaic virus was fractionated by stepwise elution from the anion exchanger DEAE-cellulose. It was found that the different fractions obtained caused different kinds of symptoms when they were inoculated into *N. tabacum*. When the virus progenies from the infected plants were investigated, phys. differences between them were found. The same chromatographic procedure was also successfully used for the purification of potato virus X.

Studies on the metabolism of valine, proline, leucine and isoleucine by rumen microorganisms in vitro.

DEHORITY, B. A., JOHNSON, R. R., BENTLEY, O. G. AND MOXON, A. L. (Dept. of Animal Sci., Ohio Agr. Expt. Sta., Wooster). *Arch. Biochem. Biophys. 78*, 15–27 (1958).

Evidence is presented that valine is oxidatively deaminated and decarboxylated by rumen microorganisms *in vitro* giving rise to isobutyric acid, and that proline undergoes reductive ring cleavage and deamination at the δ-position to form valeric acid. These fatty acids have been shown previously to enhance the digestion of cellulose by rumen microorganisms; thus the cellulolytic factor activity of valine and proline arises through their conversion to these fatty acids.

Some public health aspects of food and beverage vending.

ANON. (Dept. of Public Health, Indiana Univ. Med. Center, Indianapolis). *J. Milk Food Technol. 21*, 322–4 (1958).

This article and the two that are to follow present factual information which should help to establish the place of food and beverage vending in the environmental health program. A table summarizing the number of machines, and gross sales for different foods in 1957 is also included.

Nutrition

The influence of alternate high-protein and low-protein feeding on growth and reproduction and on regeneration of hemoglobin in rats.

DAM-BAKKER, A. W., DE GROOT, A. P. AND LUYKEN, R. (Central Inst. for Nutrition Research, T.N.O., Utrecht, The Netherlands). *Brit. J. Nutrition 12*, 259–6 (1958).

One group of rats was given a high-protein and a low-protein diet on alternate days; the other group was given every day the 2 diets mixed in such quantity and proportions that after 2 days both groups had consumed the same quantity of food of the same compn. The growth rate of young rats, given the high-protein and low-protein moieties of the diet on alternate days was less than that of pair-fed, litter-mate control animals consuming both moieties together. The less satisfactory condition of the young of the mothers given protein intermittently remained clearly manifest after weaning, when young of both groups were raised on a normal stock diet.

Products of metabolism of protein-free amino acid diets fed to rats.

HEDIN, P. A. (Univ. of Minnesota, Minneapolis). *Dissertation Abstr. 19*, 659–60 (1958).

This thesis presents data concerning quant. detn. of the major nitrogenous components, the identification and quant. detn. of amino acids and of several α-keto acids in the urine of rats fed protein-free amino acid diets. The state of nitrogen balance, the distribution of urinary amino acids and the amts. of urinary α-keto acids were investigated as part of this study.

Dietary method for induction of atherosclerosis, coronary occlusion and myocardial infarcts in rats.

WILGRAM, G. F. (Univ. of Toronto, Can.). *Proc. Soc. Exptl. Biol. Med. 99*, 496–9 (1958).

Twenty-seven, white male Wistar rats were given a diet that induced a state of hyperlipemia and produced vascular injury. The diet induced the following incidence of coronary changes 81%; atherosclerotic coronary changes 63%; coronary occlusion 33%; cardiac infarcts 14%.

Effect of dietary level of raw soybean oil meal on the growth of weanling rats.

BORCHERS, R. (Dept. of Biochem. and Nutrition, Univ. of Nebraska, Lincoln). *J. Nutrition 66*, 229–35 (1958).

Data are presented comparing the rate of gain of weanling rats fed various levels of raw or autoclaved soybean oil meal with and without supplementary methionine and penicillin plus streptomycin. Raw soybean oil meal at the 40% level supplemented with either methionine or antibiotics supported the same rate of gain as autoclaved soybean oil meal. The results rather support the conclusion that the availability of certain amino acids from raw soybean oil meal is less than that from autoclaved meal or that the requirement for certain amino acids is increased when raw soybean oil meal is fed.

Pyridine derivatives as growth factors.

Nutrition Revs. 16, 310–12 (1958).

Peking ducklings have been used to study the niacin-replacing value of a number of pyridine derivs., particularly β-picoline (3-methylpyridine), pyridyl-3-carbinol, and pyridyl-3-aldehyde. Although there was some variability in results, these 3 compds. were equiv. on a molar basis to niacin. The duckling appears to be an excellent species for such studies. The conversion of tryptophan to niacin is a relatively inefficient process in this species making it valuable for the study of vitamin interrelationships.

Genetic aspects of metabolic disease in childhood. Part I.

ANON. *Nutrition Revs. 16*, 323–4 (1958).

Congenital disease accounts for an increasingly large proportion of the population of most pediatric wards. It has been estd. that almost ⅓ of the patients in a children's hosp. at any one time have been admitted for the diagnosis or treatment of some form of congenital disease. This trend is due to both the reducing incidence of infectious diseases, and the availability of specific treatment for congenital disease. The increasing recognition of the genetic basis of metabolic disease is also responsible for this changing population under pediatric care.

Protein requirements of children.

ANON. *Nutrition Revs. 16*, 326–8 (1958).

A discussion of the contributions of 3 groups of workers with the data they presented on the protein requirements of children at the Symposium on Protein Nutrition sponsored by the New York Academy of Science. One group of workers conclude that an intake of 3 g. of protein/kg. of body wt. for 4 to 7 year olds, decreasing gradually as the child grows older but keeping well above 2.5 g./kg./day, will permit maintenance of growth of muscle and allow sufficient protein for recovery from illnesses common to children.

Intrinsic factor and absorption of vitamin B_{12}.

ANON. *Nutrition Revs. 16*, 307–10 (1958).

Studies suggest that the intrinsic factor prepd. from 1 species may have such a great affinity for vitamin B_{12} that the

vitamin cannot be absorbed from that complex by another species. Fortunately, the source of most com. intrinsic factor prepns. is hog mucosa. The intrinsic factor prepd. from that species facilitates the absorption of the vitamin by man but inhibits the absorption in rats.

Effect of major dietary constituents on growth response of rats to vitamin B_{12}.

PETERSON, E. W. AND REGISTER, U. D. (Coll. of Medical Evangelists, Loma Linda, Calif.). *Proc. Soc. Exptl. Biol. Med. 98*, 851–3 (1958).

Rats born to dams maintained on vitamin B_{12} deficient diets from mating to weaning were fed rations high in carbohydrate, fat, protein, and protein and fat with and without vitamin B_{12}. The greatest degree of deficiency was consistently observed in rats on high protein and high protein–high fat rations. Since vitamin B_{12} increased the ability of rats to utilize excess protein, one of the important functions of this vitamin appears to be the metabolism of excess amino acids for non-protein functions.

Toxicology

An investigation of the in vivo hydrolysis and absorption of propylene glycol distearate.

LONG, C. L., ZEITLIN, B. R. AND THIESSEN, R. (Research Center, General Foods Corp., Tarrytown, N. Y.). *Arch. Biochem. Biophys 77*, 440–53 (1958).

Propylene glycol distearate, labeled with propylene glycol-1-C^{14} and with C^{14} carboxyl stearate, administered orally to rats was hydrolyzed in the gastrointestinal tract to form propylene glycol monostearate, propylene glycol, and stearic acid. During the process of absorption, propylene glycol distearate is resynthesized from its hydrolytic products and is transported by the lymph. Free stearic acid and propylene glycol monostearate were not detected in the lymph. The absorption mechanism for propylene glycol distearate is similar to the glyceryl stearate esters.

FOOD AND FOOD TECHNOLOGY

Antioxidants

The role of free fatty acids on antioxidant effectiveness in unsaturated oils.

OLCOTT, H. S. (Dept. of Food Technol., Univ. of California, Berkeley). *J. Am. Oil Chemists' Soc. 35*, 597–9 (1958).

In purified, unsatd. esters and triglycerides nordihydroguairetic acid is a superior antioxidant to 6-ethoxy-2,2,4-trimethyl-1-1,2-dihydroquinoline at all levels of unsatn. In long-chain unsatd. fatty acids 6-ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline is a superior antioxidant to nordihydroguairetic acid. The addn. of free fatty acids to triglycerides, even in amts. as small as 0.05%, modifies the comparative effectiveness of antioxidants. Comparisons are given of the effect of the addn. of free fatty acids on various antioxidants in various substrates.

Cereals and Grains

Cooking quality of white rice milled from rough rice dried at different temperatures.

BATCHER, O. M., LITTLE, R. R., DAWSON, E. H. AND HOGAN, J. T. (Agr. Research Service, U. S. Dept. of Agr., Washington, D. C.). *Cereal Chem. 35*, 428–34 (1958).

Quality evaluations were made on samples of Century Patna and Rexoro varieties of rice which had been air-dried at room temp. or forced-air dried at 120° F., 140° F. or 160° F. A panel evaluated color, cohesiveness, and absence or presence of off-flavor of the cooked rice by ranking and scoring techniques. Measurements were made of volume, water absorption, starch, and total solids after treatment with water at 99° C., and also of the reaction of the rice to treatment with dil. alkali.

Dehydration

Tomato juice dehydration process.

KAUFMAN, V. F., REEVE, R. M. AND WONG, F. F. Assignors to the United States of America. U. S. 2,858,226. Oct. 28, 1958.

Raw tomatoes are reduced to a juice without rupturing the cellular portions and heated at 180°–220° F. so that the enzymes are inactivated with the pectin content remaining unmodified. The juice is then coned. and subjected to conditions of heat and vacuum to cause it to be dehydrated and to maintain an extensively expanded vol. throughout the dehydration.

Fats and Oils

Studies on the mechanism of fatty acid synthesis. V. Bicarbonate requirement for the synthesis of long-chain fatty acids.

GIBSON, D. M., TITCHENER, E. B. AND WAKIL, S. J. (Inst. for Enzyme Research, Univ. of Wisconsin, Madison). *Biochim. et Biophys. Acta 30*, 376–83 (1958).

The synthesis of long-chain fatty acids from acetyl CoA is catalyzed by 2 highly purified enzyme fractions from avian liver in the presence of ATP, Mn^{++}, HCO_3^- and TPNH. DPNH can replace TPNH although the rate of fatty acid synthesis is much less. The requirements for HCO_3^- applies to synthesis not only in the purified enzyme system but also in the unfractionated exts. of pigeon liver and rat liver. $H^{14}CO_3^-$ does not become incorporated into long-chain fatty acids during active synthesis from unlabelled acetyl CoA.

Fruits and Vegetables

New processed vegetables may diversify agriculture and diet.

SHEPHERD, A. D. AND NEUMANN, H. J. (Western Regional Research Lab., Albany, Calif.). *Chemurgic Digest 17*, 3–11 (Nov. 1958).

This article presents several possibilities for the use of new crops as foodstuffs and for non-edible purposes. Vegetables such as Chinese water chestnuts, edible-pod peas, broad beans, lotus roots, dasheen, and white mustard cabbage have been processed in a number of ways at the Western Regional Research Laboratory, and the resulting product evaluated. Investigations for the development of these vegetables through proper breeding and certification of the seed are also being carried out.

Gelatin

Hydrogen deuterium exchange reaction in fibrous proteins. I.

FRASER, R. D. AND MACRAE, T. P. (C.S.I.R.O., Melbourne, Australia). *J. Chem. Phys. 29*, 1024–8 (1958).

Measurements of infrared spectra obtained with polarized radiation are reported for nylon, silk fibroin, feather rachis, stretched wool, and kangaroo tail tendon before and after reaction with deuterium oxide. In every case except tendon replacement of hydrogen by deuterium in the peptide linkage occurs preferentially in the less well oriented regions of the specimen.

Studies of ionotropy—a special case of gelation.

HIGDON, W. T. (Shell Devel. Co., Houston, Tex.). *J. Phys. Chem. 62*, 1277–81 (1958).

A mechanism for the orientation of clay particles in suspension by an electrolyte has been proposed and discussed in the light of several expts. The roles of the electrolyte are (a) the surface of the electrolyte crystal forms the initiating surface for the orientation, and (b) the succession of increasing concn. of electrolyte from the dissolving crystal depresses the repulsion forces between clay platelets and allows the van der Waals-London forces of attraction to orient the clay platelets. Subsequent flocculation and aggregation values of electrolyte concn. in the gel fix the particles in oriented condition.

Meat

Some preliminary studies on meat flavor.

KRAMLICH, W. E. AND PEARSON, A. M. (Michigan Agr. Expt. Sta., East Lansing). *Food Research 23*, 567–74 (1958).

The purpose of this investigation was to characterize and ascertain the intensity of flavor in various meat and meat juice fractions. The character of the flavor varied greatly between the new and cooked fractions, yet upon heating the new fractions the flavor appeared to differ only in intensity. The press fluid had a highly coned. flavor. The flavor constituents were largely water sol. in both

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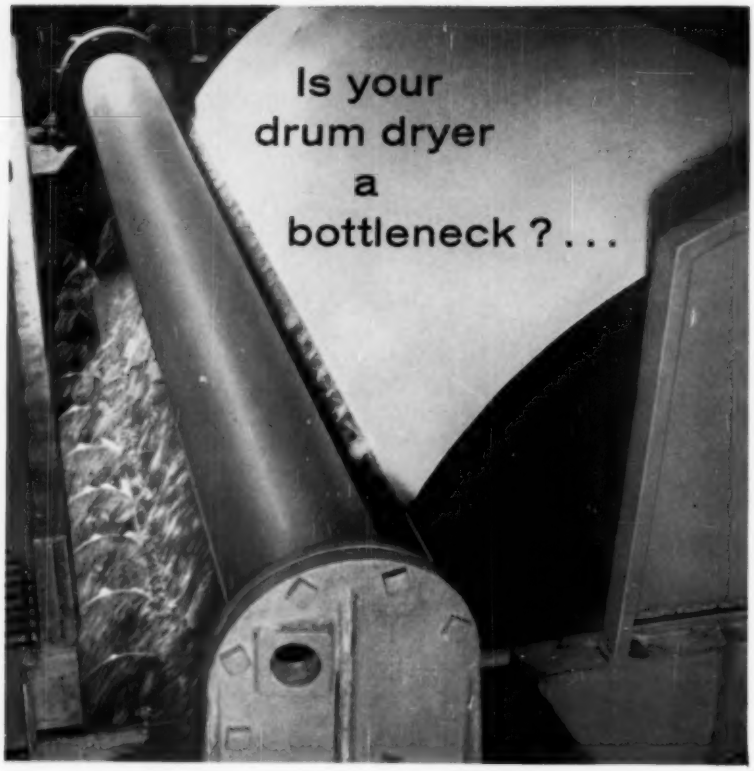

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the cooked and raw fractions. Indications were obtained that full flavor development may be due to heating of the juice and fibers together. Neither fat content, fat-free dry matter nor pH changes were responsible for differences in flavor between various fractions.

Milk and Milk Products

Relationship between in vitro lysine availability and in vivo protein evaluation in milk powders.

MAURON, J. AND MOTTU, F. (Research Lab. of Nestle's Products, Vevey, Switzerland). *Arch. Biochem. Biophys. 77*, 312–27 (1958).

The protein efficiency ratios of a series of roller-dried milk powders submitted to heat treatments of varying intensity were detd. and compared to that of the corresponding spray-dried powders. The protein level of the diets was kept at 10%. Maximum protein efficiency was obtained with spray-dried milk plus methionine. The decrease in protein efficiency in the roller powders could be almost completely restored by an adequate lysine supplement.

Nuts

Surface-active characteristics of sodium anacardate isolated from cashew nut shell oil.

BISWAS, A. K. AND ROY, A. B. (Dept. of Appl. Chem., Calcutta, India). *Nature 182*, 1299–300 (1958).

Although the surface-active properties of the sulfonated shell liquid have already been studied, no thorough investigation has yet been carried out on anacardic acid, which, being an arylalkyl surfactant and a promising bactericidal agent, needs special attention. Results of a preliminary study on sodium anacardate as a surfactant and bactericidal agent are reported here. The fact that sodium anacardate does not irritate the skin, indicates its suitability as a bactericidal surfactant. The inferior surface-active properties of sodium tetrahydroanacardate suggest that the ethylenic bonds were largely responsible for the greater soly. in water and the superior surface-active properties of sodium anacardate.

Taste Testing

Discernment of taste substances as affected by solvent medium.

MACKEY, A. (Oregon State Coll., Corvallis). *Food Research 23*, 580–3 (1958).

Taste substances were less easily detected in oil than in water soln. An aq. soln. of cellulose of the same viscosity as oil gave a greater taste perception than oil but smaller than water. When in oil, the bitter substances were especially hard to detect. It is concluded that the bitter taste, when noticeable in foods is carried in water soln. rather than in liquids.

PERSONNEL

Colonel James P. Littlejohn, USA (QMC), has assumed command of the United States Army Quartermaster Food and Container Institute for the Armed Forces in Chicago. He replaces Colonel Ervin L. Keener, USA (QMC), who has been reassigned as Deputy Commander, Utah General Depot, Ogden, Utah. Col. Keener has served as Commandant at QMFCIAF since 20 August 1957.

As Commandant, Colonel Littlejohn will administer the Institute's research and development program on foods for the Army, Navy, and Air Force, and containers for most Quartermaster supplies. The Institute seeks answers to current military operational food and container problems and in addition is at work on problems that will have to be faced in the future under the changing logistical patterns of military operations. Prior to assignment to the Institute, Col. Littlejohn was the Senior Advisor, QM SKORA, Korean Military Advisory Group.

He was commissioned as second lieutenant in the Infantry Reserve in 1932 after graduating from Clemson in South Carolina, with a degree in engineering. The Colonel is a native of Clemson. He also did graduate work in economics and commerce at the University of North Carolina.

In 1940, Colonel Littlejohn was called to active duty and served in the European Theatre of Operations during most of World War II. He was awarded the Bronze Star Medal in recognition of his wartime service.

In June 1947, he was integrated into the Regular Army and assigned to the Quartermaster Corps. From August 1951 through August 1954, Col. Littlejohn served in various posts in Europe. He was an instructor at Quartermaster Schools at Fort Lee, Virginia, from October 1954 to January 1957.

Col. Littlejohn graduated from the Quartermaster Subsistence School in 1948 and has attended the Air War College and the Army Supply Management Course.

He was employed as a sales engineer with the General Electric Company prior to military service.

Col. and Mrs. Littlejohn and their two children will live in LaGrange, Illinois.

The appointment of **Dr. Kevin G. Shea** to the staff of the Princeton Division, Curtiss-Wright Corporation, as Senior Scientist in the Nuclear Radiation Department, was announced by H. S. Bamford, General Manager. Among Dr. Shea's duties with Curtiss-Wright will be to review the company's food irradiation program and act as staff advisor on the development of techniques for the application of nuclear radiation to industrial production problems. In joining Curtiss-Wright, Dr. Shea left the Interdepartmental Committee on Radiation Preservation of Food, Washington, D. C., where he served as executive secretary. Prior to that position, he was a food technologist with the Office of the Quartermaster General, Department of the Army, served as laboratory director for B. Heller & Co., and was a biochemist with the National Canners Association.

Dr. K. G. Shea

Robert Krone, Manager of Fritzsche Brothers, Inc. Flavor Sales Division, attained Quarter-of-a-Century Club status when he completed 25 years of service with the New York essential oil firm on Friday, February 13th. A luncheon celebration was held in his honor at Charles' Restaurant the following Monday, at which time he received an engrossed scroll indicative of his membership in this exclusive club. He was presented a substantial Government bond by the officers and directors of the firm, and a portable television set by his fellow employees.

The pectin operation of General Foods Corporation in Hollywood, Calif. has been consolidated with the Atlantic Gelatin division with headquarters at Woburn, Mass. according to Clement H. Watson, division general manager. **Dr. Avery Dunn** will be responsible for sales and technical services of both gelatin and pectin products. The pectin research program will continue under the direction of **Raymond E. Cox** in Hollywood.

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The appointment of **David G. Bernard** as general manager of sales for American Can Company's Canco Division has been announced by **Robert C. Stolk,** vice president in charge of the Division's sales department. Mr. Bernard formerly was assistant general manager of the commercial development department, Canco Division.

A nationally prominent food technologist will point the way to increased markets for canned fruits when he reports the progress of a continuing research program to the nation's top executives of the canning industry scheduled to meet at San Francisco's exclusive Bohemian Club next April 21st. **Emil M. Mrak,** Chairman of the University of California's Department of Food Technology, will tell the canners that application now of some of the results learned so far from the extensive and continuing investigations at U. C. can bring lower costs and greater consumer acceptance through increase in ease

yields, improvement in dessert quality, orderly flow through the cannery, product uniformity, and improved sales. At the same time, the U. C. professor will stress that the research results were obtained under pilot plant operation using commercial equipment.

On the same program, **George F. Garnatz,** director of the Kroger Food Foundation, Cincinnati will give the results of extensive consumer acceptance tests made in California and the Midwest using the U. C. pilot plant pack processed by the methods Mrak will reveal.

During the past decade, per capita consumption of canned fruits has stayed at almost the same level while home canning has decreased and personal income has increased. At the same time, other dessert foods have been taking a growing share of the expanded dessert market. Because of these trends together with the importance of fruit growing in the State's farm economy, the University of California's Department of Food Technology in 1951 inaugurated a far-reaching program of continuing research on the quality of canned fruits and their acceptance by the buying public.

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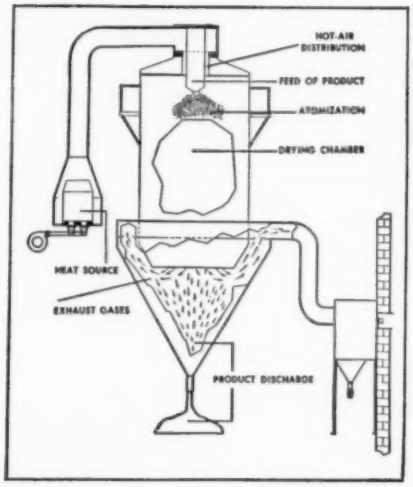

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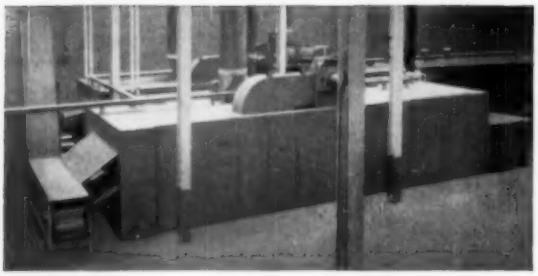

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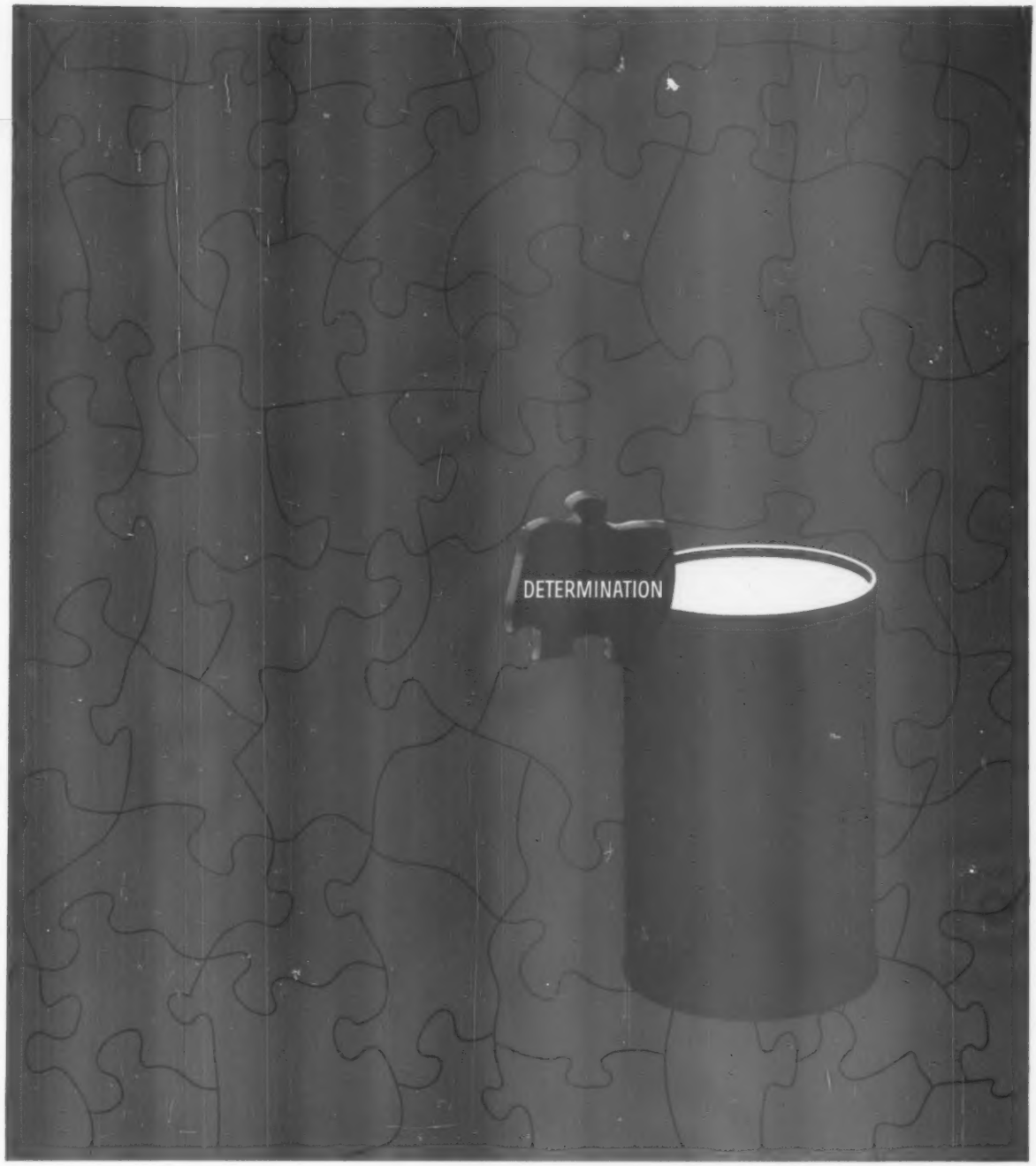

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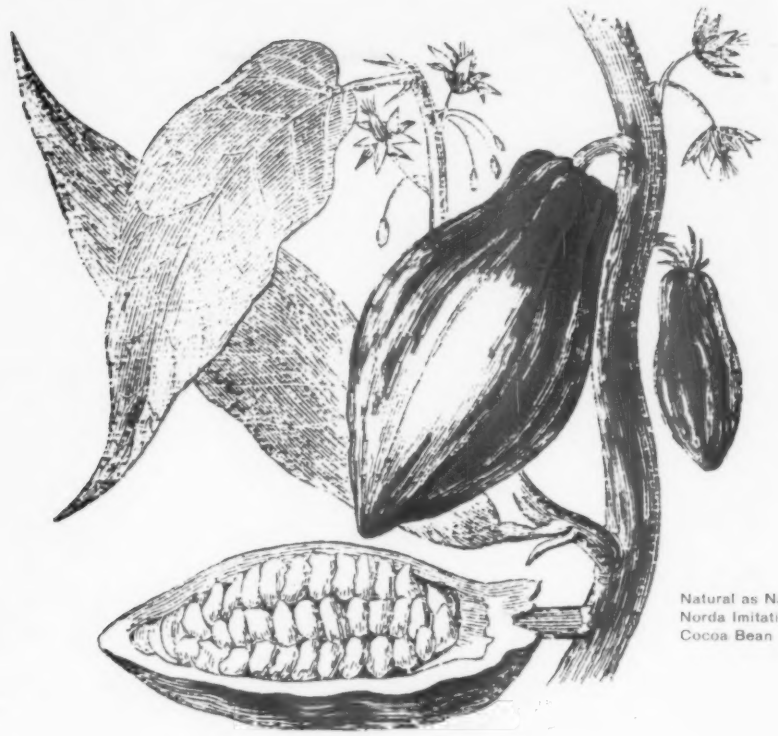

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